The Engineering and Mining Journal

VOL. LXXXV. NEW YORK, APRIL 25, 1908. NO. 17.

The Cananea Blast Furnace

Full Details and Drawings of a Copper Blast Furnace, Embodying the Results of Experience with Many Types in the Same Works

BY CHARLES F. SHELBY*

The Cananea Consolidated Copper Company has recently installed eight new blast furnaces to take the place of eight others which had been in commission for varying lengths of time up to seven years, and which, having done their duty, were worn out. These old furnaces were represented by seven different types, ranging in size from a hearth area of 42 to 60 in. in width and from 120 to 210 in. in length, and with varying distances from the tuyeres to the feed-floor of from 9 to 17 ft.; some had a large bosh and others were absolutely straight; there were 3-in. and 5-in. tuyeres, high and low bottoms, water-jacketed and brick spouts, 20 odd different types of jackets, etc., etc.; the intention of the original builders having been to try out for themselves all the different characteristics of a furnace in order to determine which was best adapted to the Cananea charge. The results finally obtained were embodied in the furnace here described, and which combined all the best points of the old furnaces.

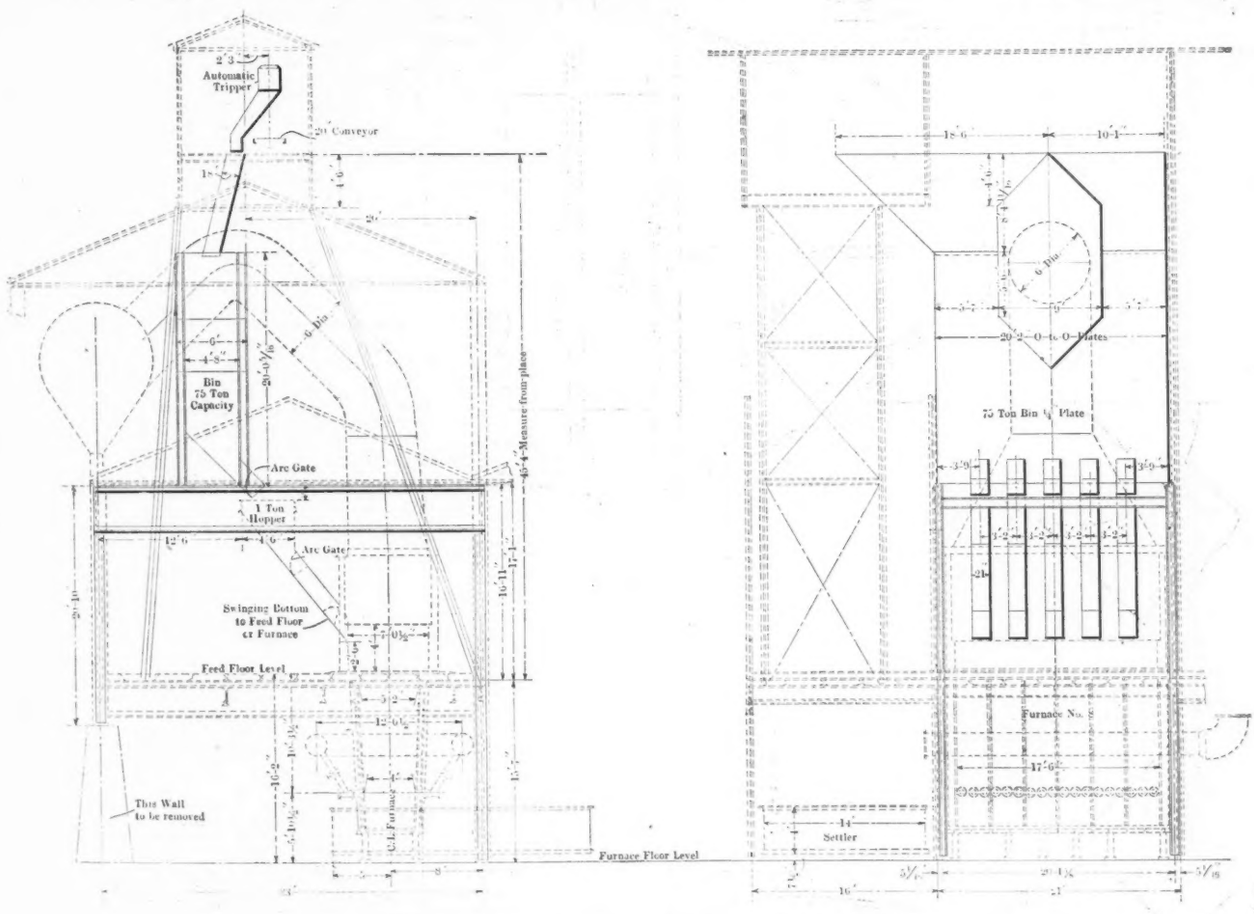


FIG. 1. GENERAL OUTLINE OF ORE-BINS, FURNACE, ETC.

Conditions Governing Design

It was of necessity designed to fit certain conditions and to occupy a definite space without interfering with the general construction of the building or altering established grades, both of which changes would have involved heavy expenses; otherwise the furnace would have been increased in length in accordance with E. P. Mathewson's ideas, the value of which he has certainly proved beyond a doubt when worked in harmony with a smeltery where there is no question as to the supply of material to be treated. A few other differences of minor importance might have been incorporated in the design also, had not fixed conditions precluded their adoption.

While the management of the Cananea company, the engineering staff and the writer are directly responsible for this furnace as a whole, still in detail it is more of an assemblage of proven principles than new ones; and to the reader who may feel that he is the originator of

*Superintendent of Reduction Division, Cananea Consolidated Copper Company, Cananea, Mexico.

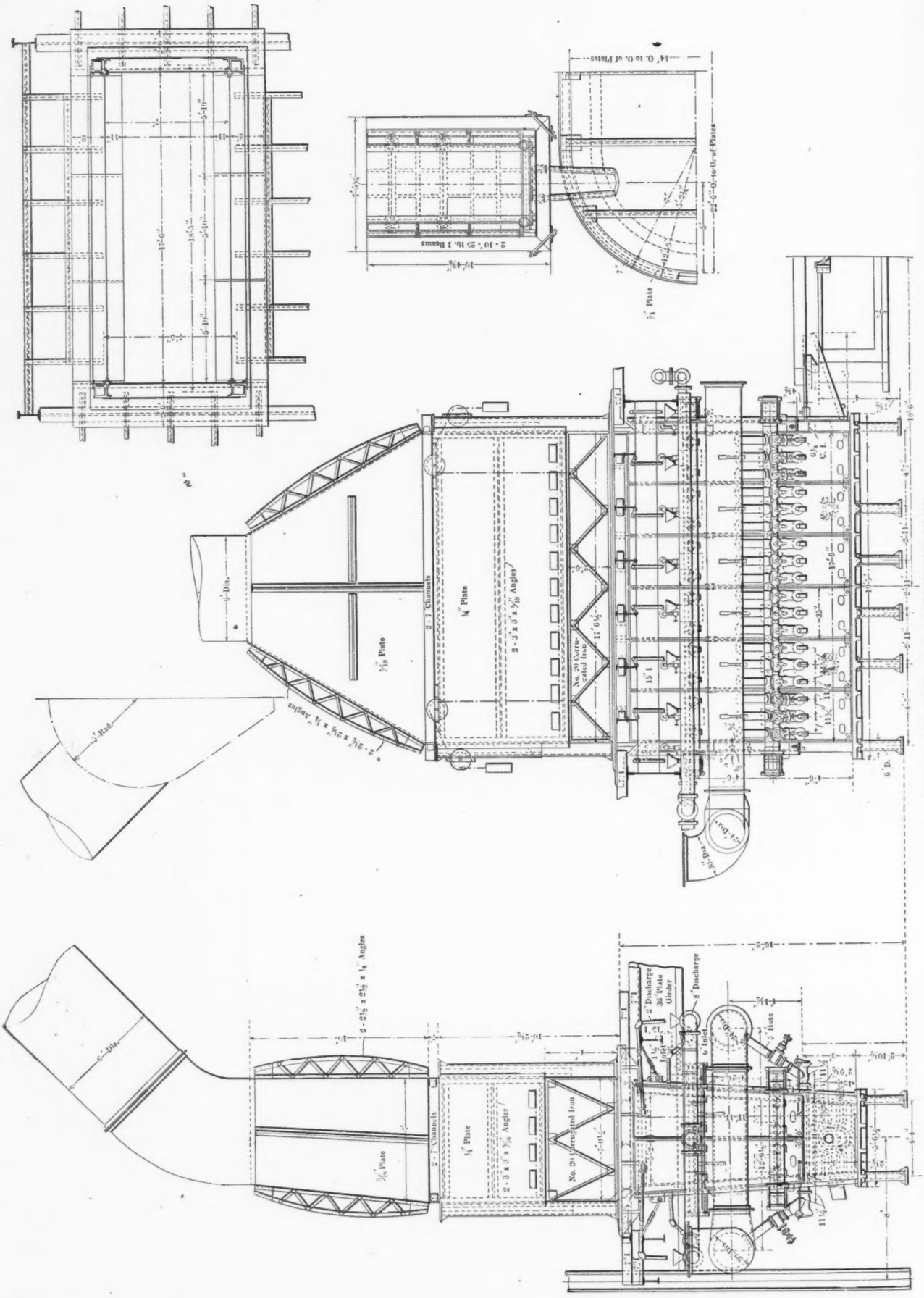

2 - 10" - 25 lb. I Beams
14' O. to O. of Plates
22'-6"-O.-to-O.-of-Plates
¾" Plate
2 - 7" Channels
¾" Plate
2 - 3" x 3" x 5/16" Angles
No. 20 Corrugated Iron
5/16" Plate
2 - 2½" x 2½" x ¼" Angles
6' Dia.
6' Rad.
2 - 2½" x 2½" x ¼" Angles
2 - 7" Channels
¾" Plate
2 - 3" x 3" x 5/16" Angles
No. 20 Corrugated Iron
5/16" Plate
2 - 2" Discharge 30" Plate Girder
8' Discharge
6' Intake
2" Hole

FIG. 2. SIDE AND END ELEVATION AND PLAN

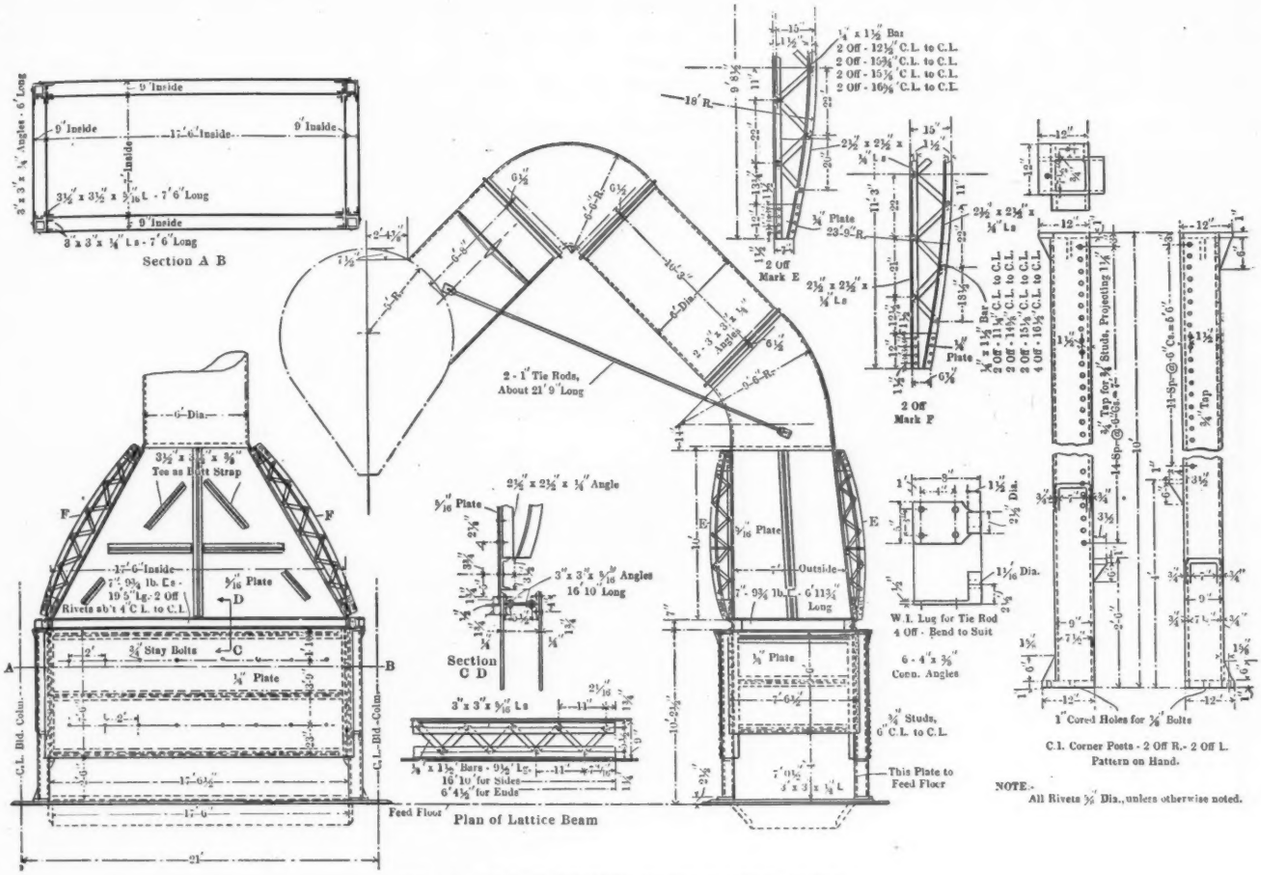

Section A B
Section C D
Plan of Lattice Beam
2 - 1" Tie Rods, About 21' 9" Long
2 Off Mark E
2 Off Mark F
W.I. Lug for Tie Rod 4 Off - Bend to Suit
6 - 4" x 3/8" Conn. Angles
1" Cored Holes for 3/4" Bolts
C.I. Corner Posts - 2 Off R. - 2 Off L. Pattern on Hand.
NOTE - All Rivets 7/8" Dia., unless otherwise noted.
This Plate to Feed Floor
Feed Floor
C.L. Bld. Colm.

FIG. 3. SUPERSTRUCTURE ABOVE FURNACE FLOOR

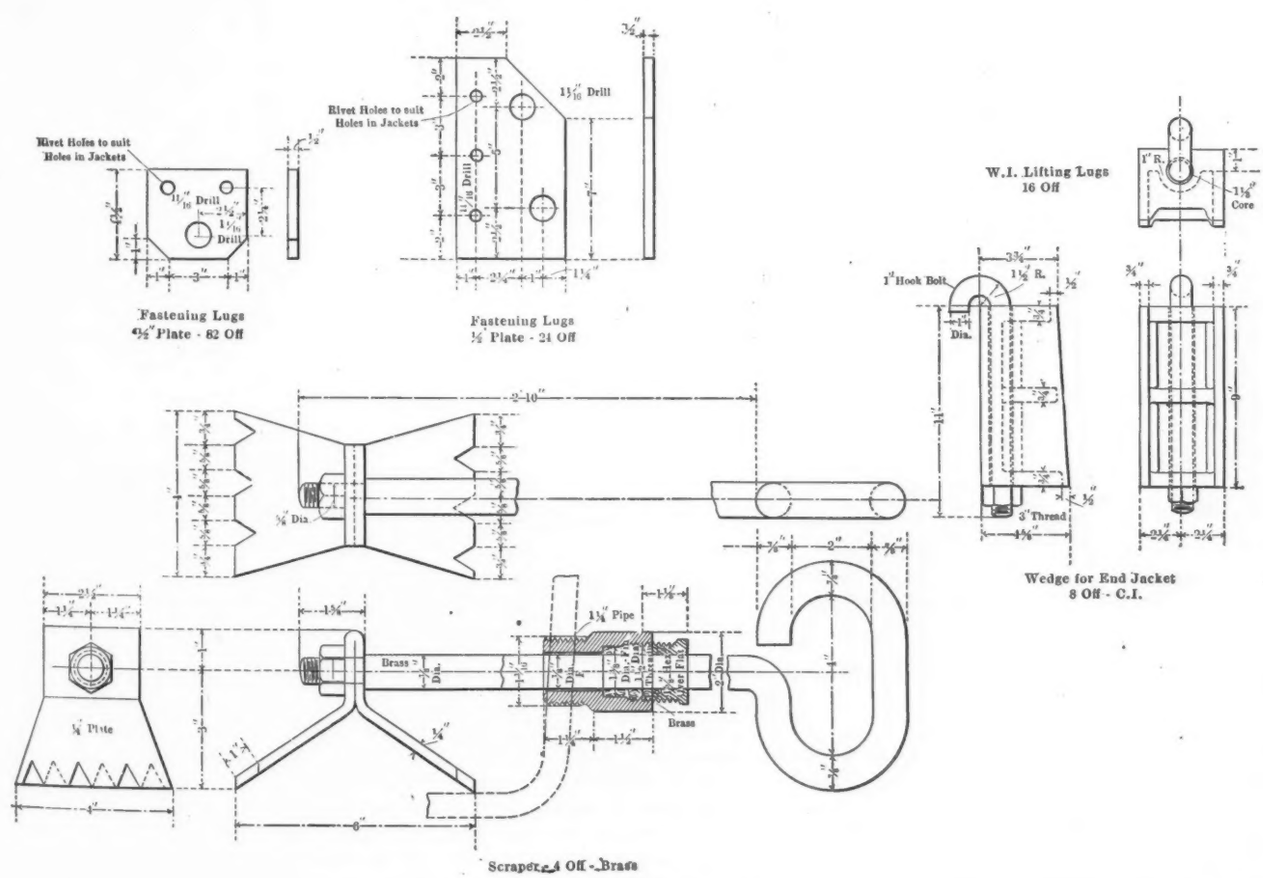

Fastening Lugs 9/16" Plate - 82 Off
Fastening Lugs 1/2" Plate - 24 Off
W.I. Lifting Lugs 16 Off
Wedge for End Jacket 8 Off - C.I.
Scraper - 4 Off - Brass
Brass
1 1/4" Pipe

FIG. 4A. DETAILS OF JACKETS

any ideas that have been embodied in this design we wish to give due credit and extend our thanks, and hope that he will see in the accompanying illustrations and description something new which may be of benefit to him.

Fig. 1 herewith is a preliminary study and gives a general outline of the end and side elevations from the slag-track level to the gas flue, showing a proposed arrangement, now being installed, on the feed-floor for feeding a self-fluxing mixture into these furnaces directly through the chutes illustrated, with the option of deflecting the same to the feed-floor and shoveling it in to balance up irregularities. This self-fluxing mixture will be made at a point removed from the blast furnaces and in charges of 8000 to 10,000 tons, which will be gathered up as a homogeneous mixture, with a satisfactory reclaiming machine, and deposited on a belt conveying system, which will discharge the ore into the bins shown, one of which is provided for each of the furnaces. The small gas flue which is shown in this drawing resting on one of the building columns, and into which the goose-neck from the blast furnace leads, will eventually be removed and a dust

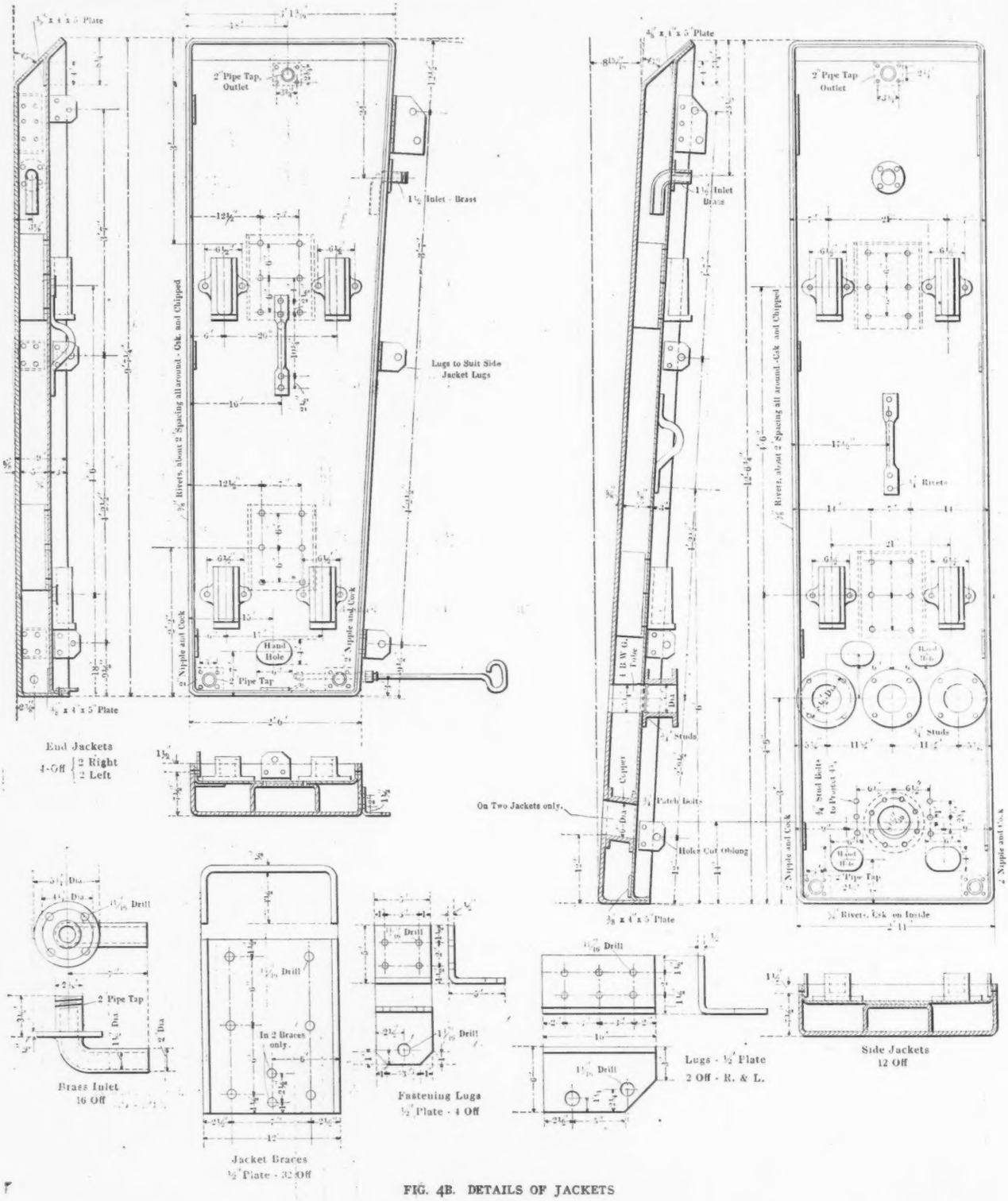

End Jackets
4 Off { 2 Right 2 Left
Brass Inlet 16 Off
Jacket Braces ½" Plate - 32 Off
Fastening Lugs ½" Plate - 4 Off
Lugs - ½" Plate 2 Off - R. & L.
Side Jackets 12 Off
On Two Jackets only.
Hand Hole
Nipple and Cock
Holes Cut Oblong
Lugs to Suit Side Jacket Lugs

FIG. 4B. DETAILS OF JACKETS

chamber of ample area located in the space to the left.

Design of the Furnace

Fig. 2 shows a side and end elevation of the furnace proper.

Fig. 3 is a general and detailed drawing of the superstructure, or that part of the furnace above the feed floor. The absence of brick will be noticed. The lower part of the furnace hood is built up of ¼-in. plates, spaced 9 in. apart, and forming practically an air jacket with open top and bottom around the furnace. In this manner any accumulation of slag or any other substance that might be thrown up from the furnace charge out of blow-holes and impinged on the side of the furnace cannot hang there as tenaciously as it could in the case of a brick top, and after attaining some weight it falls off of its own accord. This inside plate is kept cool by a current of air passing up between it and the outside plate, and the outside plate also serves to protect the workmen from any annoyance from heat radiated from the inside plate. The goose-necks might have been better of larger diameter, but at the time this furnace was designed the removal of the balloon-shaped flue was not seriously considered, and it was not deemed advisable to cut a larger hole in it than necessary for a 6-ft. pipe. The horizontal flue having only an area of about 80 sq. ft., a larger sized goose-neck would have been useless, considering that one section of this flue must accommodate the gases from four furnaces, the flues from which have a greater combined area than that of the balloon flue.

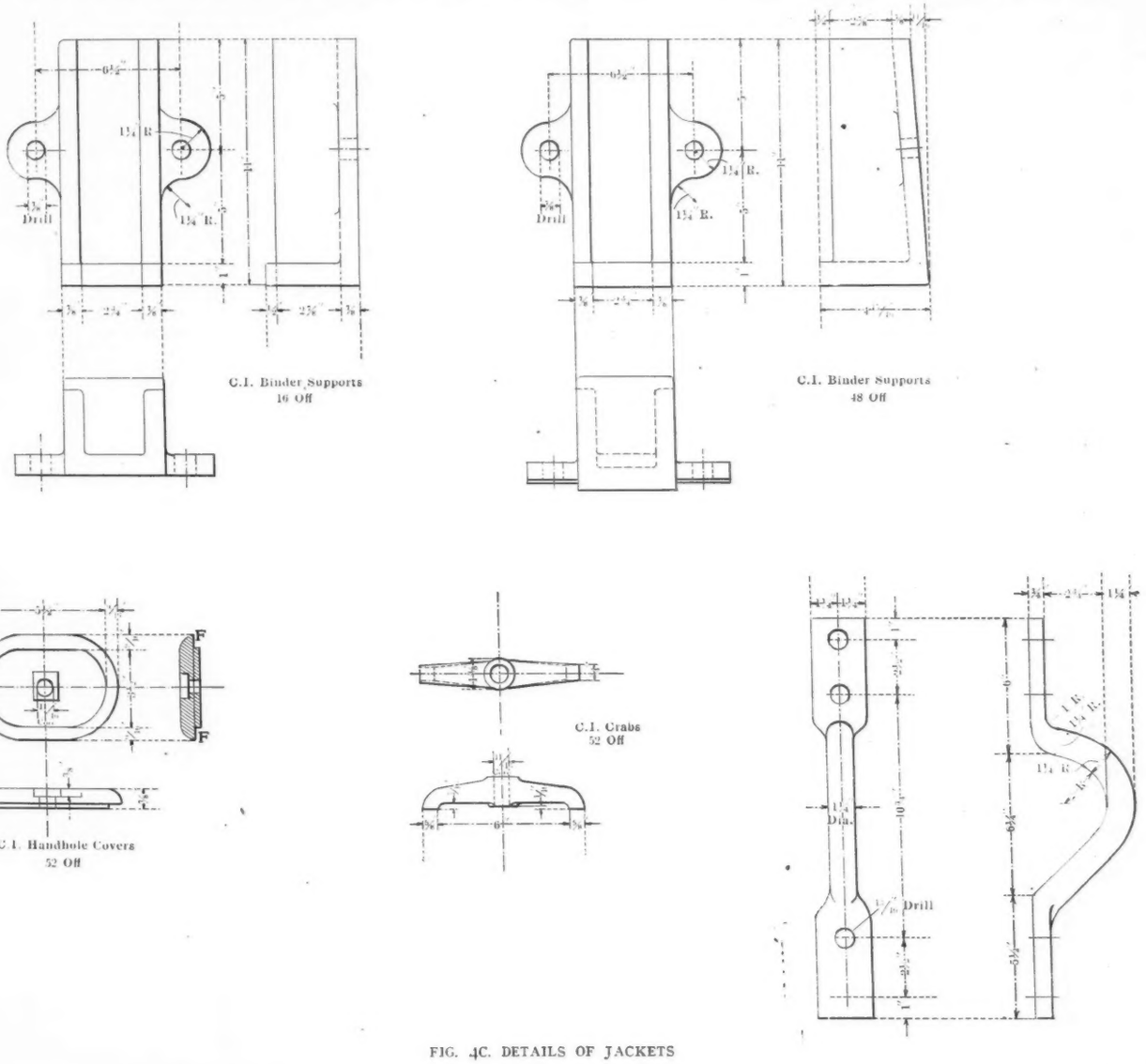


FIG. 4C. DETAILS OF JACKETS

The Jackets

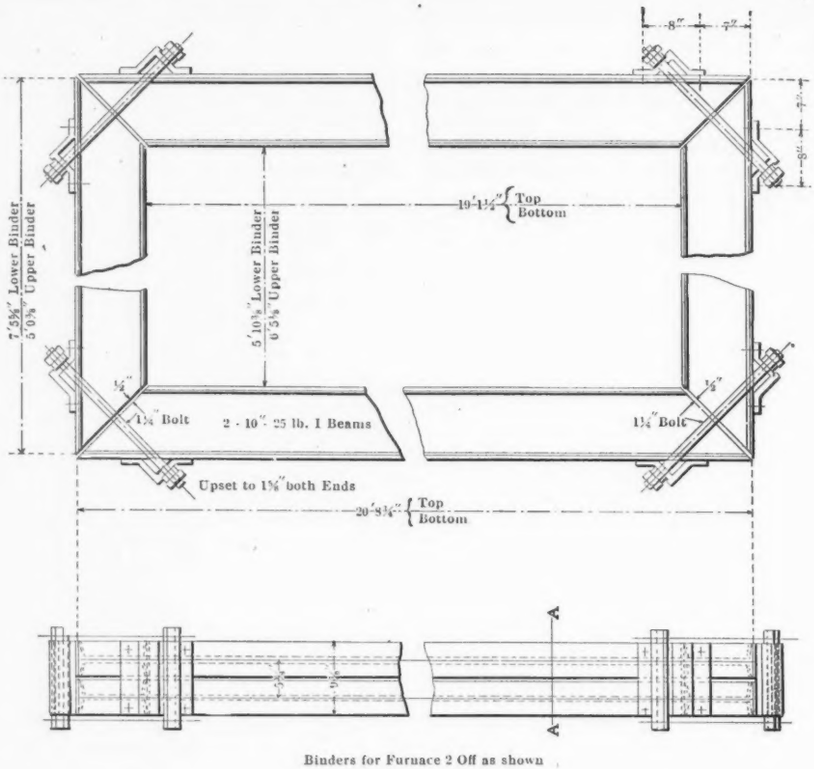
Fig. 4 is a detail of the jackets used on this furnace. It will be noticed that the side jackets are 12 ft. 6 in. long, which is greater than customary dimensions. The furnace, however, is well bound, and after a period of six months of continuous usage it was noticed that the deflection of the binders at the center of these furnaces was only 1⅜ in. for the upper and 1½ in. for the lower binder. A reading taken before the furnace was started showed that in tightening up the binders a deflection already existed of ½ in. on the upper and 3/16 in. on the lower. The inner sheets of these jackets are made of ⅝-in. flange steel plate and the outer sheets of ⅜-in. and, being so strongly constructed themselves, are expected to give continuous service without any repairs whatever—extraordinary accidents only excepted—for a period of two to three years or longer. The object in making one long jacket instead of two tiers of shorter dimensions, which would mitigate the bending strains, is to avoid the chances for scale or sediment to accumulate on the bottom of a jacket where directly exposed to the fire. My experience has been that more trouble will arise from burning holes in an upper tier of jackets than from the central deflection of one long jacket.

Another feature worthy of notice is the auxiliary tap hole which is provided on two jackets on each furnace for the pur-

pose of drawing off the contents of the crucible when the furnace is shut down. As the furnace is operated with a water-jacketed continuous-overflow spout, and the bottom of the crucible is too low to discharge into the settler, an arrangement of this kind is necessary; and I have found that the design illustrated in this drawing is very satisfactory, and have used it for a period of four years without one instance of trouble. I think the idea was used previously by Mr. Gough, at Descubridora. The water inlet is located on the vertical center line of the jacket and 23 in. from the top, and the outlet directly over this at the highest point in the jacket. I have used jackets 15 ft. long with the water inlet at the top, and I am a firm believer in putting the cold water in here, although there are probably more instances where it is led into the bottom of the jacket, and where good work is being done. Hand-holes are provided at the lower extremity, directly above the tuyeres, to clean out any scale that may be deposited in the bottom of the jacket or dropped down from above, in large pieces, and lodged on the tuyeres. Blow-off taps are also provided to keep the bottom of the jacket clean in case of muddy water. Channel sections are provided to transmit the strain from the inside of the furnace to the binders, and scraper rods are provided for the end jackets, the bottoms of which do not reach to the crucible plate, depriving them of the mud-drum principle on the side jackets.

The Binders

Fig. 5 is a detail of the binders, two sets of which are provided for each furnace. It will be noticed they are made of 10-in. 25-lb. section I-beams. It would be considered better practice by a number of engineers to have these binders located at least a few feet away from the furnace, and to interpose tension and compression members in the shape of turnbuckles or jacks, or something similar, between these binders and each one of the jackets. In this way a chance would be provided to facilitate the quick changing of any one of the jackets. This principle was not adhered to, first, because the space was not available to put these binders at any other point than exactly where they are without running into serious complications, and second, because I do not expect to change any of these jackets for a long time; and when they are changed, in the course of about three years, it will be better practice to put in an entire new set and scrap the old ones, which will certainly have done their work by that time. These jackets are well constructed and should not give any trouble from burn-outs whatever, excepting under extraordinary circumstances of gross inattention on the part of the water tender; and should a crack or small hole be developed for this reason, in the majority



Binders for Furnace 2 Off as shown

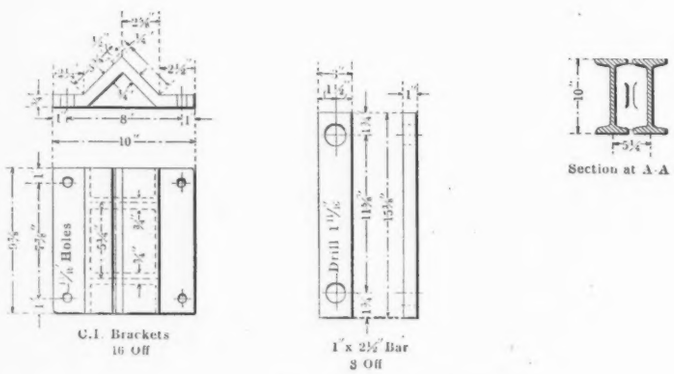


FIG. 5. DETAILS OF BINDERS

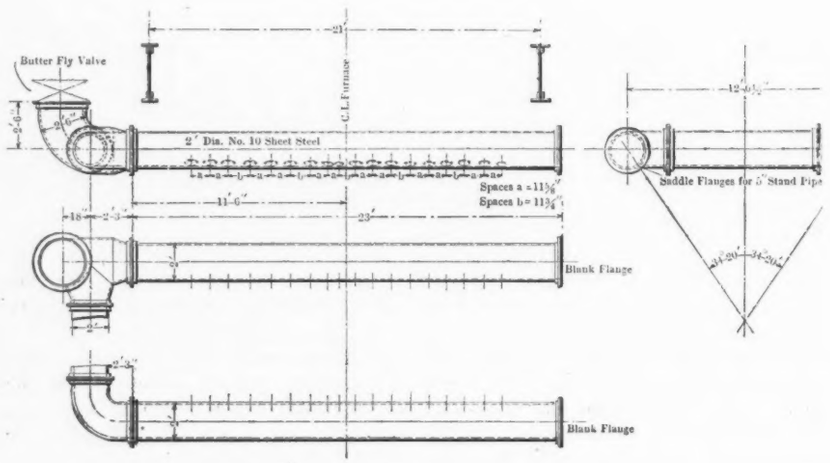


FIG. 6. DETAILS OF BUSTLE-PIPE

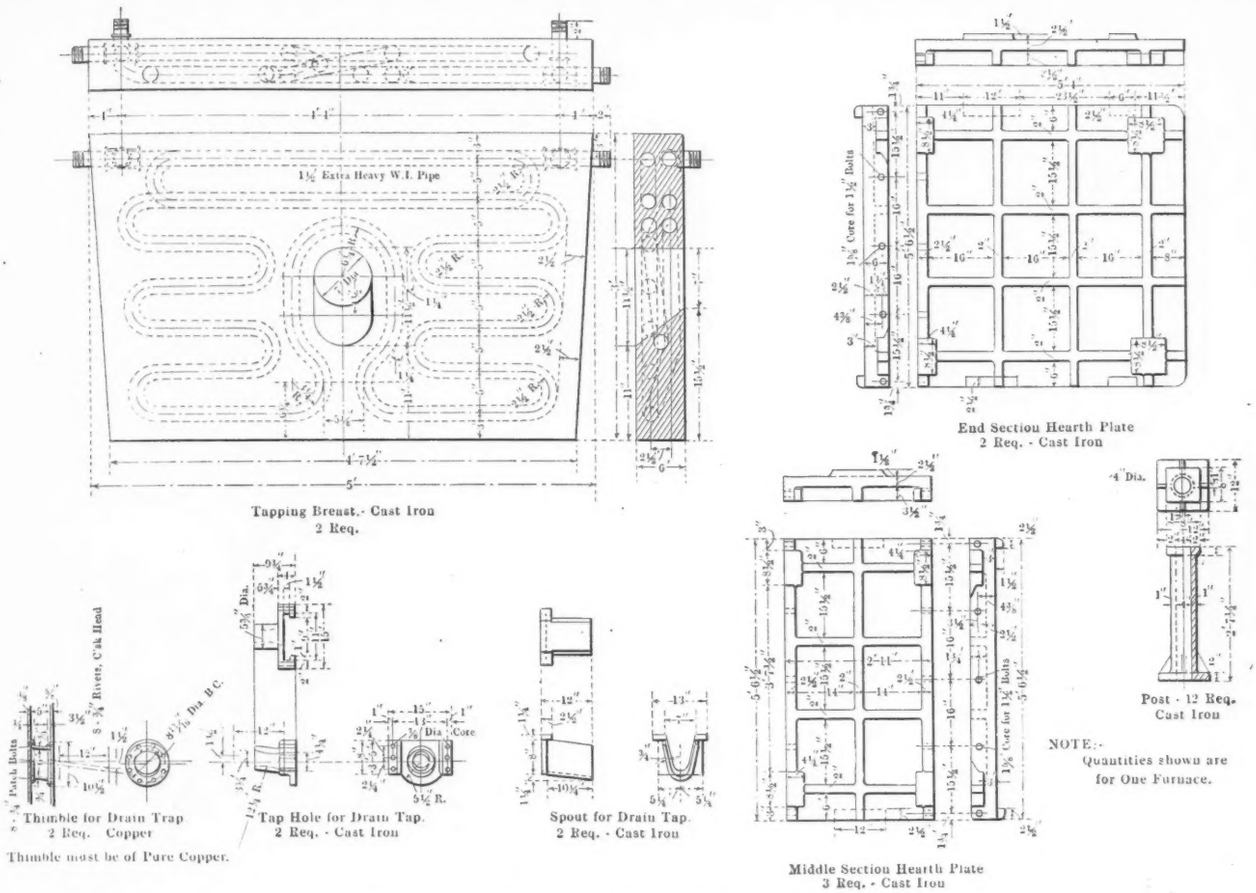


FIG. 7. CAST-IRON DETAILS, LOWER PART OF FURNACE

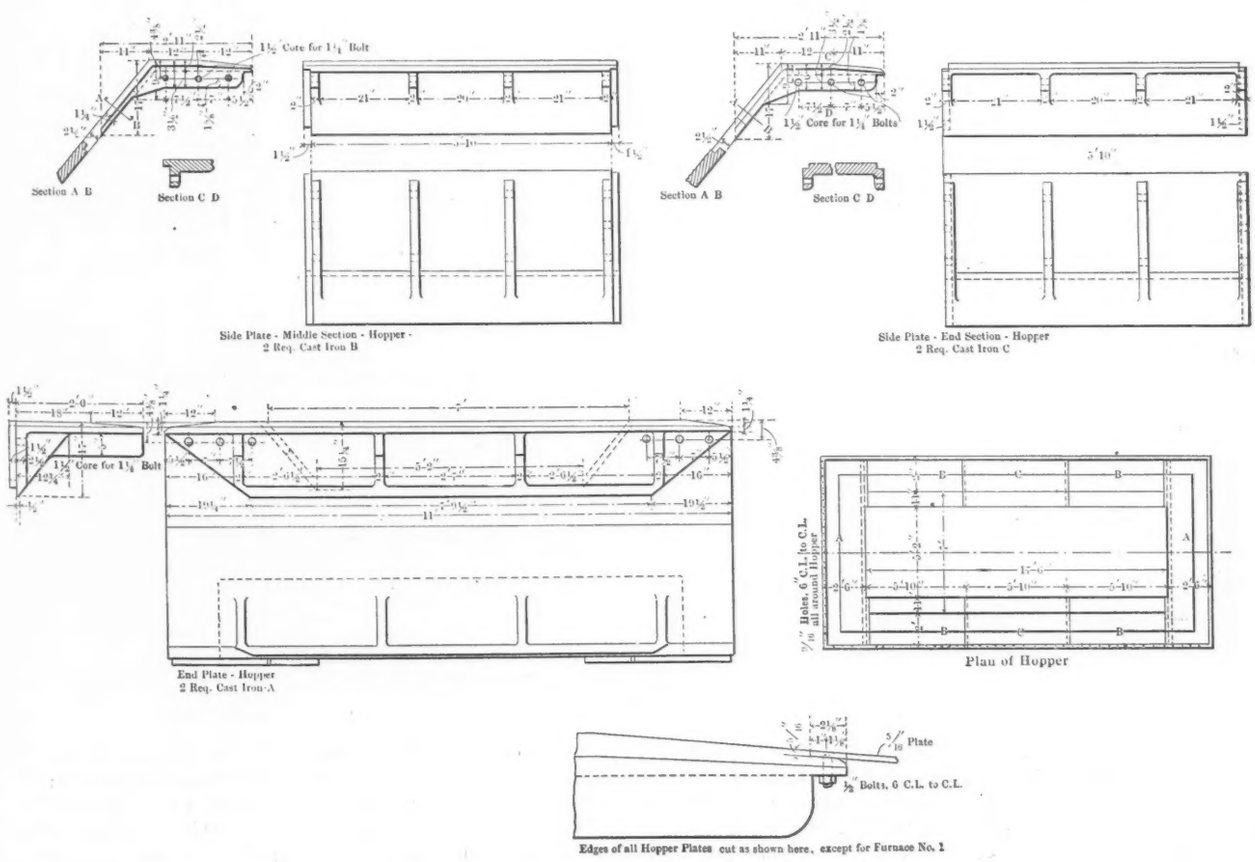

Section A B
Section C D
Side Plate - Middle Section - Hopper -
2 Req. Cast Iron B
Side Plate - End Section - Hopper
2 Req. Cast Iron C
End Plate - Hopper
2 Req. Cast Iron A
Plan of Hopper
Edges of all Hopper Plates cut as shown here, except for Furnace No. 1

FIG. 8. CAST-IRON DETAILS OF HOPPER PLATES

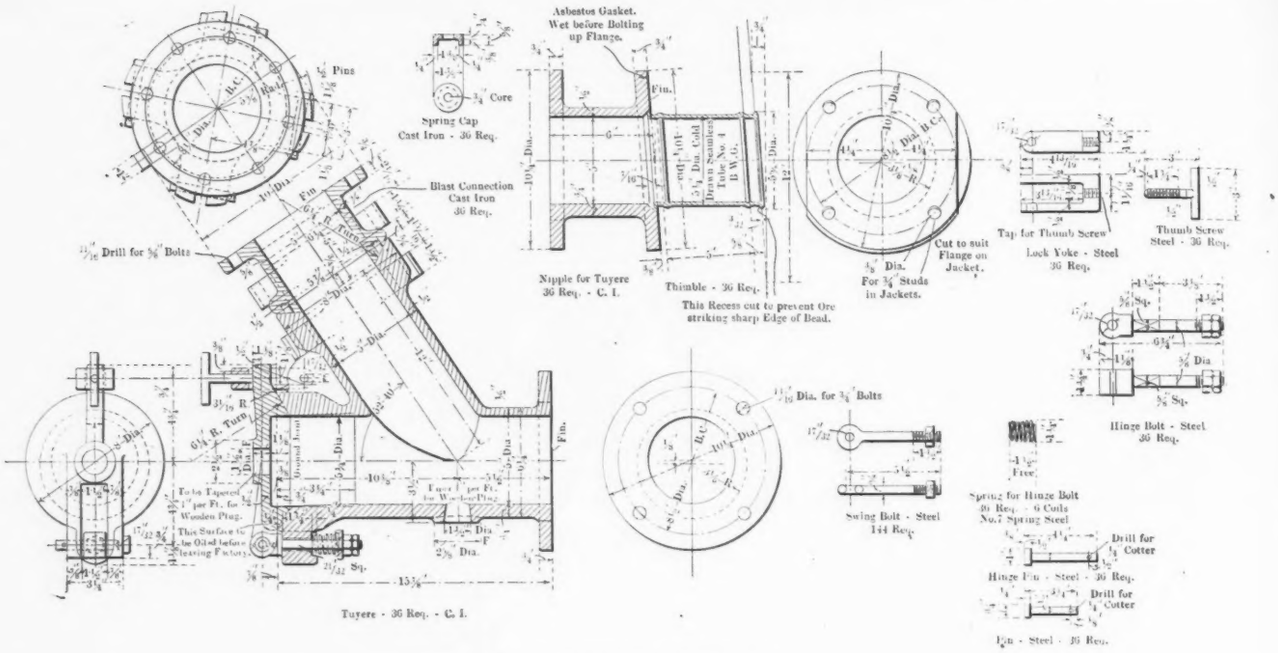

Asbestos Gasket. Wet before Bolting up Flange.
Spring Cap Cast Iron - 36 Req.
Blast Connection Cast Iron 36 Req.
Nipple for Tuyere 36 Req. - C. I.
Thimble - 36 Req.
This Recess cut to prevent Ore striking sharp Edge of Bead.
Cut to suit Flange on Jacket.
For ¾" Studs in Jackets.
Tap for Thumb Screw
Lock Yoke - Steel 36 Req.
Thumb Screw Steel - 36 Req.
Hinge Bolt - Steel 36 Req.
Spring for Hinge Bolt 36 Req. - 6 Coils No.7 Spring Steel
Hinge Pin - Steel - 36 Req.
Swing Bolt - Steel 144 Req.
Tuyere - 36 Req. - C. I.

FIG. 9. TUYERES AND DETAILS

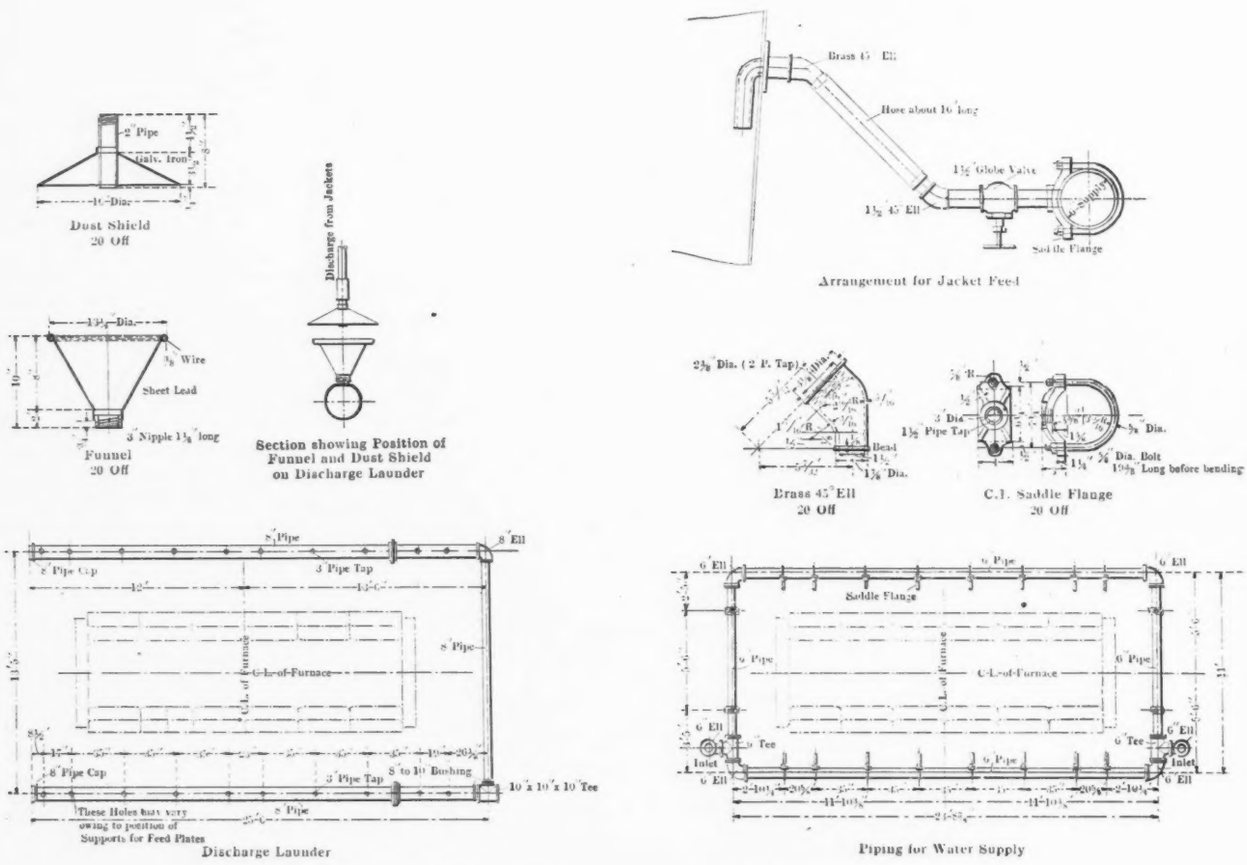

Dust Shield 20 Off
Funnel 20 Off
Section showing Position of Funnel and Dust Shield on Discharge Launder
Arrangement for Jacket Feed
Brass 45° Ell 20 Off
C.I. Saddle Flange 20 Off
Discharge Launder
Piping for Water Supply

FIG. 10. WATER SUPPLY AND DISCHARGE PIPES

of instances it can be repaired just as well in place by welding the crack together, by welding on a patch, or by fastening on one with patch-bolts and subsequent calking. I have repaired jackets, in which the now almost extinct practice of stay-bolting had been used, and in which the heads of the stay-bolts had been either burned off or been pulled out in the upper part of the shaft by simply letting the charge down below these points, shutting off the blast and drawing off the furnace, and covering the top of the charge with a thin layer of flue dust, after which men would get in the furnace, tap out the holes, screw in copper plugs and start off again in a very short space of time.

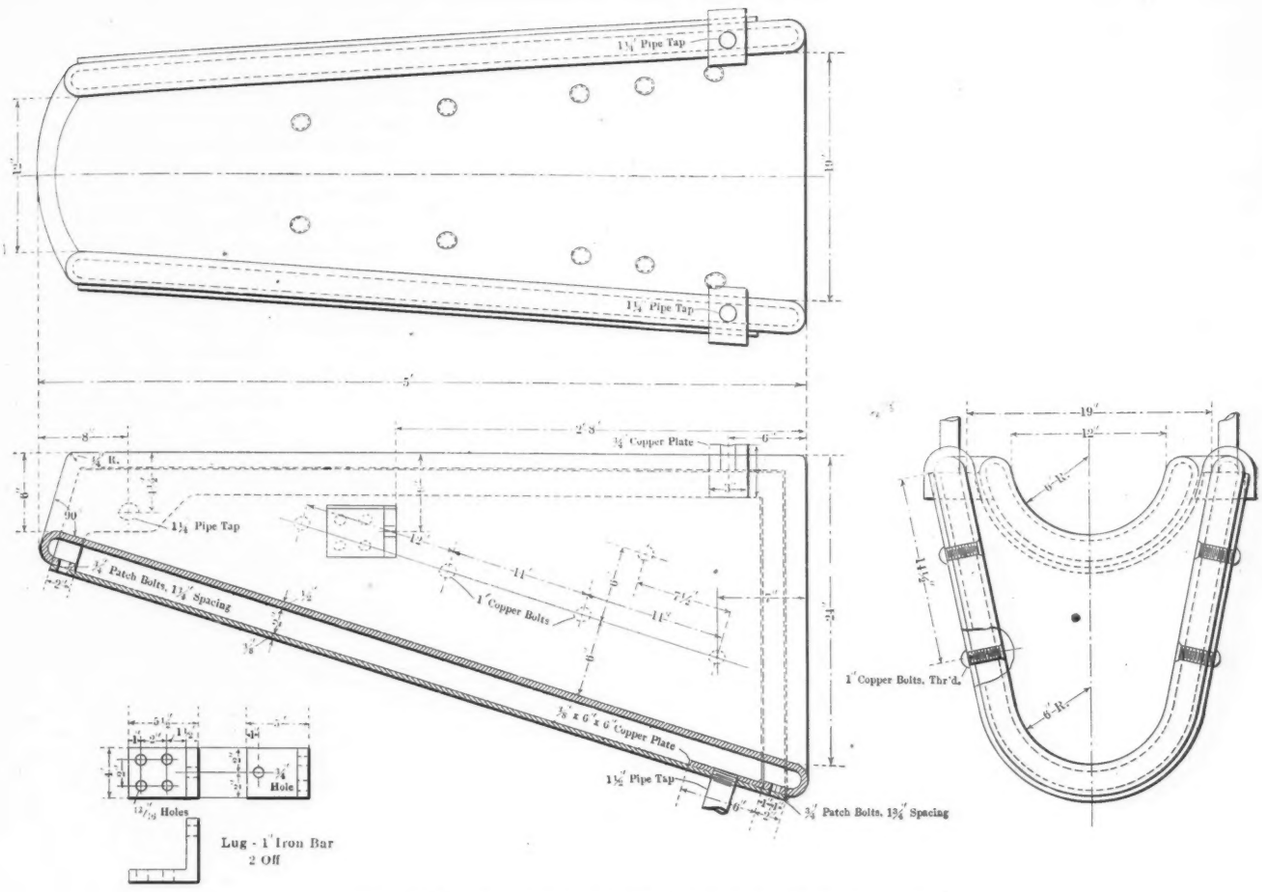


FIG. 11. DETAILS OF WATER-JACKETED MATTE AND SLAG SPOUT

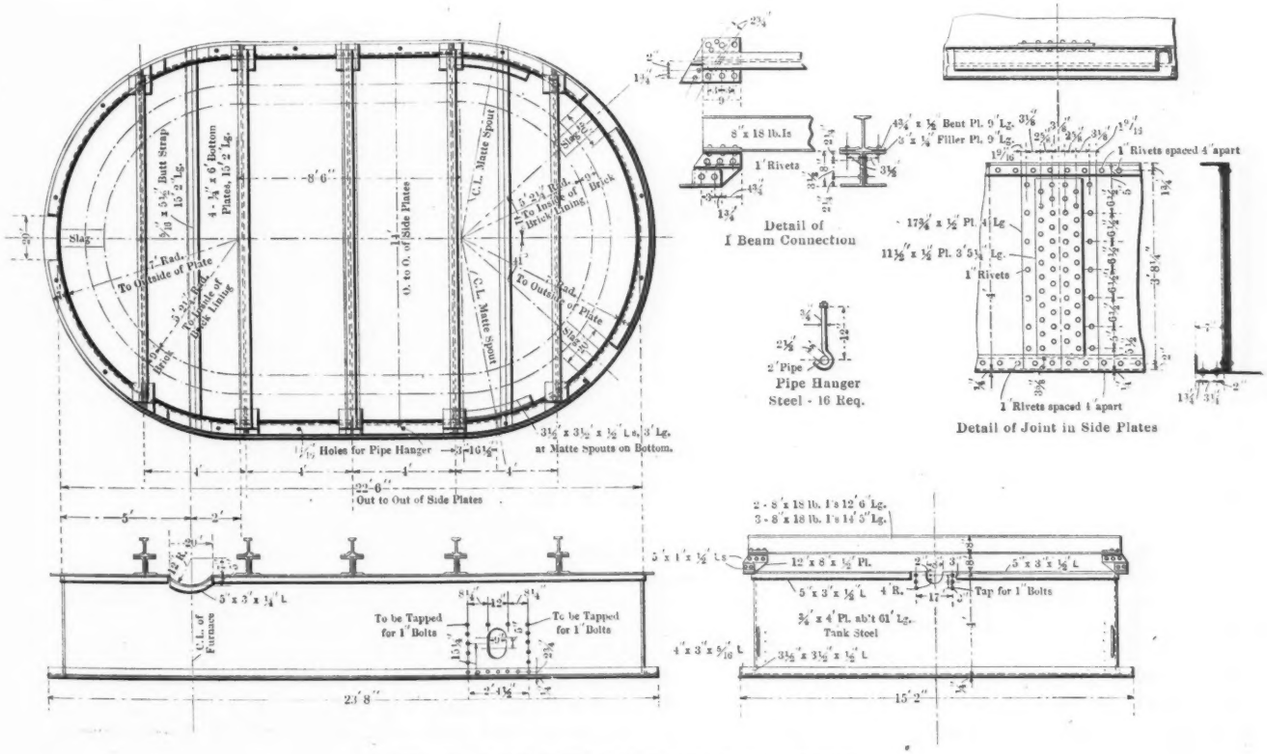

Slag
Butt Strap
4 - ¾" x 6' Bottom Plates, 15' 2" Lg.
8'6"
O. to O. of Side Plates
C.L. Matte Spout
To Outside of Plate
To Inside of Brick Lining
Holes for Pipe Hanger
3½" x 3½" x ½" L s, 3' Lg. at Matte Spouts on Bottom.
22'6" Out to Out of Side Plates
5' x 3" x ¼" L
C.L. of Furnace
To be Tapped for 1" Bolts
25'8"
Detail of I Beam Connection
8" 18 lb. Is
1" Rivets
Pipe Hanger Steel - 16 Req.
Detail of Joint in Side Plates
1" Rivets spaced 4" apart
2 - 8" x 18 lb. I's 12'6" Lg.
3 - 8" x 18 lb. I's 14'5" Lg.
12" x 8" x ½" Pl.
5" x 3" x ½" L
Tap for 1" Bolts
¾" x 4' Pl. ab't 61' Lg. Tank Steel
15'2"

FIG. 12. PLATE WORK OF SETTLER OR FOREHEARTH

Some Details

Fig. 7 shows cast-iron details of the lower part of the furnace. This shows the crucible plate and supporting columns, a detail of the auxiliary tap-hole and the main tap-jacket. This, it will be seen, is a solid cast-iron block, in which is cast integral a 1½-in. extra heavy pipe. I evolved this design from a somewhat similar principle that I found in use at the Old Dominion Copper Mining and Smelting Company, nearly five years ago, and which had been in use there for many years previously. I must say that this type of jacket presents some advantages over any other I have ever used. If properly made, and the pipe coils looped in with the principle in view that they must cool the surface of the jacket where it is exposed to the heat, these jackets will last for an indefinite length of time; and in case of inattention on the part of the attendant and the burning away of the upper part of the tap-hole and exposing the pipes, no serious dangers in the way of explosions are liable to happen, as a small hole will first be burned in the pipe and immediately made evident by a slight ebullition in the spout. We have used tap-jackets made of pure copper and provided with a water space the same as an ordinary cast jacket, and while they generally give very good satisfaction the fact remains that when they do go it is frequently accompanied by a pretty strong explosion—sometimes sufficient to throw the spout completely over the settler and distort the other jackets.

Fig. 8 shows cast-iron details of the hopper plates around the feed-floor opening.

The Tuyeres

Fig. 9 shows a tuyere in which a number of interesting principles obtain. The main portion is fastened to the furnace, by means of a finished flange, to a companion flange already bolted to the jacket and is connected to the blast connection by means of a rough ball-and-socket joint which is provided with a groove for an asbestos gasket; by adjusting the bolts which fasten these two parts together a perfect alinement of all the blast connections can always be maintained. The lower part of the tuyere is provided with a slag escape hole, which is stopped in the old fashioned way with a wooden plug; and although I have observed almost every other method in use of taking care of this contingency, the one shown appeals to me as being the most effective after all. If a lathe is available in the carpenter shop the tapered round wooden plug is by far the most simple safety valve to make for this purpose. Flat wooden wedges are used with good results, but they are generally more difficult to manufacture; lead disks must be purchased, and a waste plug leaks air. The cap of the tuyere itself is seated to the tuyere proper by means of a ground joint which is perfectly air-tight; after one adjustment of the spring at the bottom and the thumb screw at the top no further attention is necessary; the tuyere can always be opened and closed quickly and an air-tight joint always maintained. This cap is also provided with a hole that is ordinarily closed in a manner similar to the slag escape, and which is used as a peep hole, or for irregular punching of the tuyeres. The internal dimensions of this tuyere enlarge toward the cap to facilitate the quick removal of chilled slag.

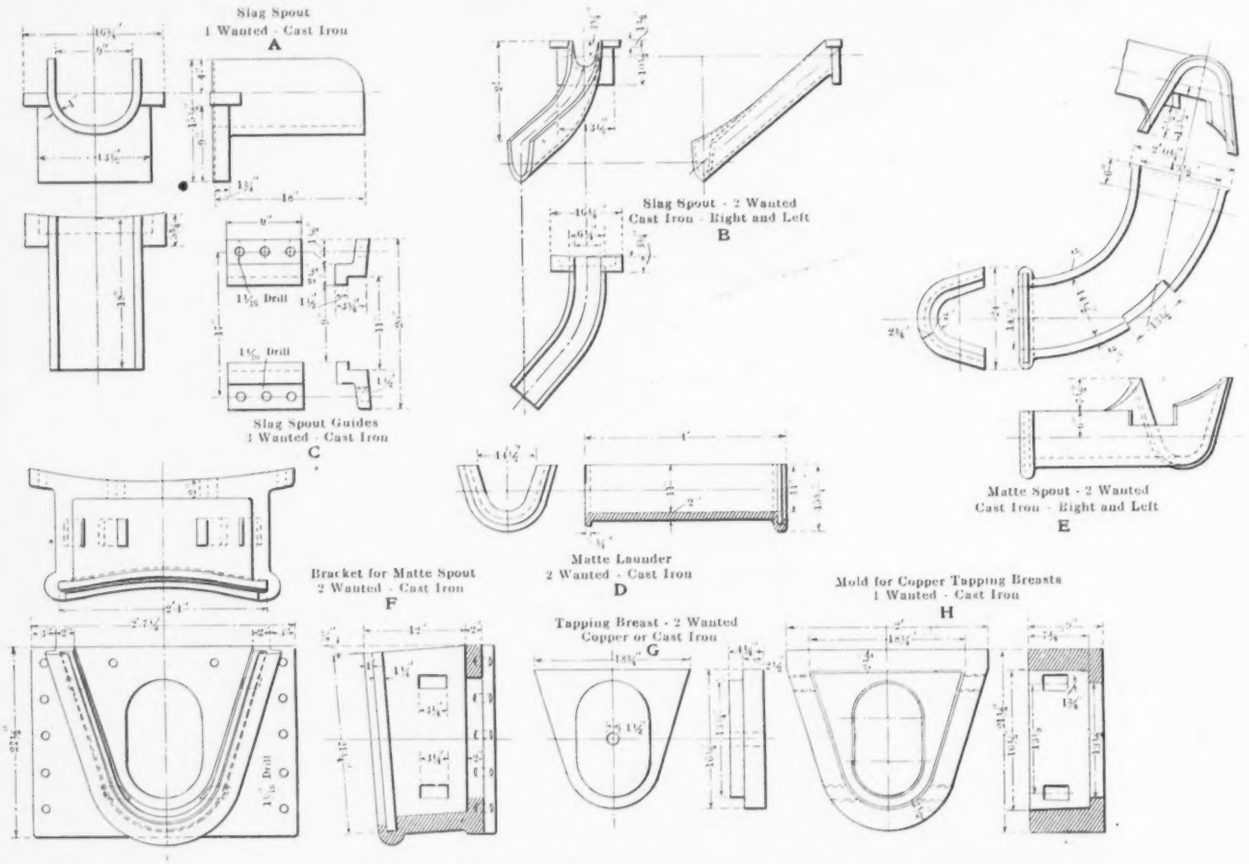


FIG. 13. CAST-IRON DETAILS FOR SETTLER, OR FOREHEARTH

The manner of punching the tuyeres, to which I give preference, consists in opening the cap entirely and closing off the individual gate-valve above. The attendant stands at one side of the tuyere and with a curved rod jars up the cold material inside of the furnace; the blast pressure then blows out all the loosened material. This is kept up until the fire flies. In this manner a couple of men can go around a furnace in a short time and keep the tuyeres always in good condition, which is, as we all know, one of the essential features in getting good work out of a furnace.

On the same drawing is shown a boiler-tube tuyere thimble which passes through the jacket. Since this drawing

was made, this method has been improved upon by welding this tube to the inner sheet and doing away with the necessity of a bead, which is always liable to peel off. I have tried for a number of years to have this principle put into effect, but by reason of not calling on a party who was willing to tackle the job—quite a few had the chance—I was unable to secure a specimen until the season of 1907, and it would only be just to give S. W. Traylor credit for having turned out an exceptionally fine piece of work in welding these tuyeres to the jacket, with the oxy-acetylene flame.

Fig. 6 is a detail of the bustle pipe.

Fig. 10 shows the water supply header and arrangement for taking off the discharge water, both surrounding the furnace. In this water-supply pipe attention is called to the saddle flanges that are used to take the water off for each jacket, which practice is considered as good as, and much cheaper than, the use of ordinary pipe fittings. Attention is also called to the rubber-hose connections between the jacket proper and the water-supply pipe; this, being flexible, will allow for any distortions of the furnace without resulting in broken pipe connections and other similar annoyances.

Fig. 11 is a detail of a water-jacketed overflow matte and slag spout.

The Settler, or Forehearth

Fig. 12 is a general and detailed drawing of the plate work of the settler or forehearth.

Fig. 13 shows the cast-iron details for the settler.

Fig. 14 shows my method of lining a settler. This consists first in lining the bottom with 10 in. of refractory fireclay brick, the upper layer of which is replaced by one layer of chrome brick directly underneath the spouts and around the tap-holes. The sides are lined with 9 in. of chrome brick all the way up, the outside lines of which are located 12 in. from the steel shell, the intervening space being filled up with a mixture of crushed silica and clay, the same as is used in lining converters, excepting that barren material should be used here. I have had excellent results with settlers lined in this manner, and can mention one that went into commission at the Old Dominion Copper plant in October, 1904, and on which no brick repairs whatever were made until at least June, 1907; as far as I know it may still be in commission. This settler was lined with only 4½ in. of chrome brick instead of 9 in. as shown in this drawing, but was not subject to the action of as low a grade of matte as has been made at Cananea. My experience indicates a preference for chrome brick over magnesia in lining settlers, and the magnesia for converter work. I am trying out the bauxite, but as yet do not care to go on record as to their merits. I can refer to three of these settlers at the Cananea plant which have been in commission at various times since January, 1907, until November, when operations were suspended, the side walls of which are almost as perfect as the day they were put in; the bottoms also with one exception. There was a point in the bottom of one of these settlers, however, which was burned out through a misconception of the value of results on the part of the attendants. The converter slag is poured directly into this settler, and a hole in the crust must be kept open for that purpose. The attendants discovered that by dropping cast iron into this hole a constant ebullition would ensue which would save them the work of opening the hole in case the converter slag was not coming quite fast enough to keep it open. This practice was supposed to have been stopped, but contrary to orders the men kept on putting the iron in, when they had the opportunity to do so without being observed, and this finally resulted in burning a hole through the bottom at this point.

A very important feature in connection with this settler is the 12 in. of material called the "converter lining." The chrome brick in itself is a good conductor of heat and subject to quite an expansion factor, and if placed directly against the steel shell the chances are that it would burst the settler; if not, the loss of heat through conductivity through the brick and radiation outside would be so great as probably to freeze up a large portion of the settler. The spongy, silicious and clayey material interposed between these bricks and the shell being a non-conductor, serves as an insulator as well as an expansion safeguard, and keeps the heat in the settler where it belongs; and instead of these large settlers freezing up, one furnace can keep them sufficiently hot all the time, and two furnaces—for which they were designed—so hot that at times a spray of water is used to keep the shell cool. This water is simply a preventive, and by keeping the shell cool further eliminates expansion troubles.

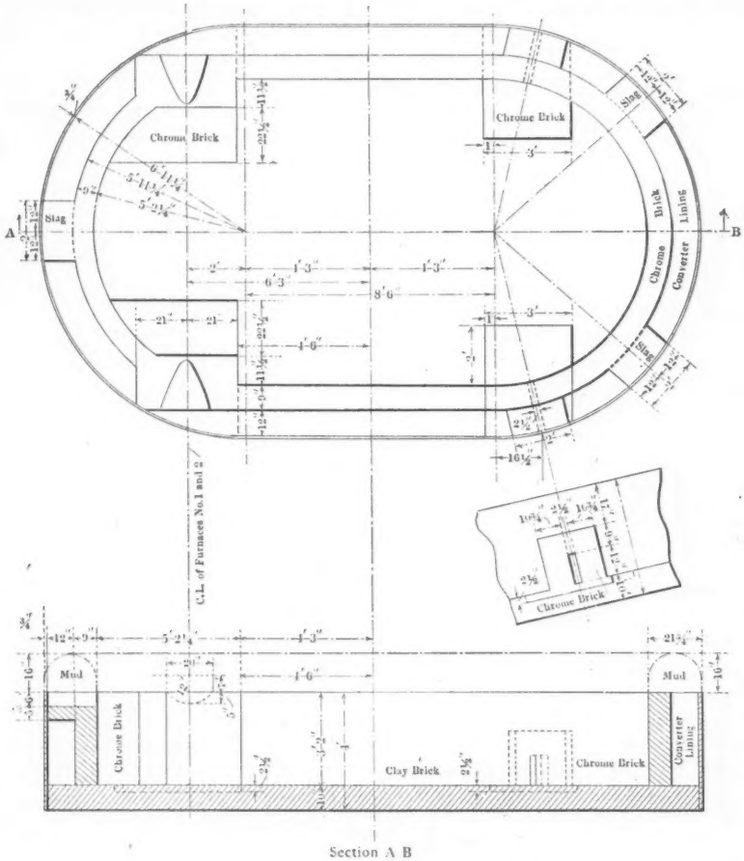


FIG. 14. METHOD OF LINING A SETTLER

Construction

Having introduced the name of one manufacturer in this article, it also gives me pleasure to state that W. N. Small, of El Paso, Texas, assisted us greatly in furnishing all the castings, and the jackets for six of these furnaces at the rate of one a month after receiving orders. Roscoe Cornell, of El Paso, through the company whom he represents, at Milwaukee, furnished two sets of jackets and binders in equally good time, and S. W. Traylor an order for extra jackets with the welded tuyeres—a fine piece of workmanship.

J. W. Peters, of Cananea, built the entire superstructure for all of these furnaces, connecting up the goose-necks to the gas flue and the wind connections to the main blast pipes without even a

temporary interference to the blast or draft for any of the other furnaces. And to W. L. Thomas, Wm. Gmehling, Capt. C. H. Croker, F. Robusch, R. L. Samuels, L. S. Kuhn and other leaders of the mechanical force at Cananea credit is due for the workmanlike manner in which the furnaces were assembled, some having gone into blast in a week's time after the castings and jackets had been unloaded from the cars.

The furnace has maintained an average daily tonnage of 462 wet tons charge, excluding coke, over a monthly period. Of this charge 35 per cent. would pass through an 8-mesh, and 50 odd per cent. through a 4-mesh screen.

Custom Tunnels for Drainage and Transportation of Ore

SPECIAL CORRESPONDENCE

Transportation and drainage tunnels in the State of Colorado have not been financial successes. I mean especially companies organized to build long cross-cut tunnels for the purpose of drainage and for conveying to the surface the ores and waste of veins owned by others.

There are many reasons for this lack of success. The chief one seems to be that the owners of mines and veins to be intersected were not consulted or induced to sign haulage and drainage agreements prior to the commencement of driving the bore, the tunnel projectors seemingly having taken their chances of getting them after completing the work.

An instance of this is a tunnel driven three miles to cut the veins of an old and prosperous gold camp, about 1500 ft. below the surface.

The projector was advised at the outset to see the mineowners and get drainage contracts signed. "Oh, no," said he, "wait till I get there, and they will have to come and see me." "But suppose," said the other, "they refuse to pay anything after you have cut their veins, and the water is running out of your tunnel." "Then I'll bulk-head them," he said. So he went on and drove his tunnel, and did drain a number of mines, and the owners laughed at him, and he didn't bulk-head them either. I was working in the camp at the commencement of the enterprise, and heard the surface comments on the subject. Some said, "It's very kind of him to come in and unwater our mines; we didn't ask him to, and we'll just make a drain of his old tunnel." One man went still further, and said, "I'm going to use the mine water for our concentrating tables, and if he drains it away, I'll sue him for damages." Another manager said, "We are working very comfortably at 500 ft., and the mine is paying; we are not going to spend the money to sink a shaft another 1000 ft. to his tunnel level, or raise from the same to a connection with our workings, unless he happens to strike our vein in a pay shoot."

And this last, by the way, is hardly ever done.

The foregoing is a sample of the early talk and most of them kept their word. The tunnel company has been through two reconstructions, and has never paid interest on the original capital. Now, however, by dint of careful and skilful management, the engineer in charge has for the first time made the tunnel pay running expenses, in spite of the fact that a long barren zone had to be passed through. The tunnel is now about to enter the richest and thickest net-work of veins, and as the owners will not pay for drainage, the manager very properly declined to advance his heading any further till they do.

ADJUSTMENT OF CHARGES

The regulating of pay for drainage is a rather difficult problem. You can charge a man so much per ton for his ore or waste, by keeping a man at the adit to tally the number of cars sent out; but the water will run out anyhow, and with a lot of mines discharging into the tunnel, the proportion is hard to gage. The mineowners may prefer still to work their mines from the surface, where they have their plants erected, but the water runs down the walls of the veins, and escapes into the tunnel; and so having no pumping to do, they can work their mines at a still greater profit.

What would seem an equitable plan would be for every mine in the camp to pay a drainage tax of so much per ton on every ton of ore hoisted and marketed. Some would probably agree to this; some, of course, would not. For instance, we will say that a wet mine working at 1000 ft. agrees; a dry mine on the same vein, working at 400 ft., refuses, and says, "We are not bothered with water; why should we pay," ignoring the fact that the other mine which has agreed to pay, is taking its water.

As it is an admitted fact that the tunnel will drain, and so benefit the camp as a whole, it must also be admitted that the whole ought to contribute toward its drainage and maintenance.

When connection is made by the mines with the tunnel, and the ore and waste are then transported through it, the haulage charges per ton can include the drainage charges for such mines. The mineowners in this particular instance only want to pay for haulage and drainage at and below the tunnel level, but this is manifestly unfair, for the majority of the big mines are down 800 ft., and the total depth at which the tunnel will cut them is 1500 ft., so that the tunnel manager will have to drain 700 ft. more of the whole camp before he gets anything for it. However, the tunnel will eventually get an enormous tonnage, and the camp reap a tremendous advantage, so there is no doubt but that the level heads on both sides will come to a mutually advantageous understanding.

An 8x9-ft. tunnel was run in Cripple Creek half a mile through the granite rim into the breccia area, and cut ten veins which were being worked at various points on the surface from 200 to 700 ft. above the tunnel level, in pay ore; but not one of them was intersected by the bore in a pay shoot. When the owners of the veins on the surface were shown that they could come into the tunnel and work their veins by overhead stoping, and get their ore out for 50c. a ton, as against $2 per ton which it was costing many of them to hoist to the surface, they said, "The ore shoots of this district are very irregular, and it will not pay us to come into the tunnel and rise to look for ore, when we are working in ore on the top." That tunnel cost $80,000, and was a failure.

Another tunnel in the same camp was driven one and one-half miles, and for the same general causes is in a receiver's hands. But its heading is in the richer portion of the district.

Even with an agreement for haulage and drainage with the surface owners, in cutting a network of veins, it is hard to tell which veins cut in the tunnel are whose on the surface. This can be determined only by making connections, which, as already shown, is not always profitable or convenient.

The Cripple Creek deep drainage tunnel is quite another matter, for in this case the owners of the big mines of the district which were to be benefited, combined and subscribed the money to build it; but this is for drainage only, and not for transportation of ore.

The Smoke Nuisance at Indianapolis

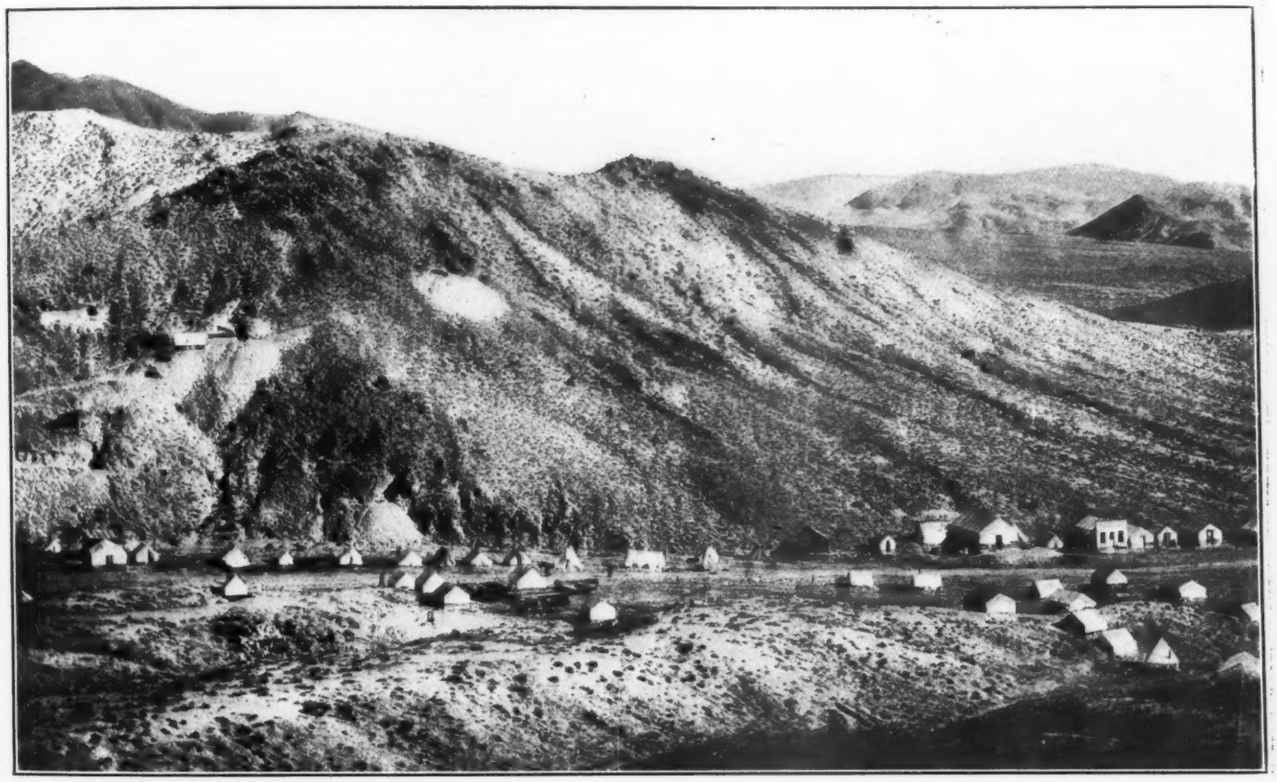
Violations of the smoke ordinance have become so flagrant and numerous at Indianopolis, that a committee of the Board of Trade is to investigate the question. The State statistician has sent out blanks for reports on the kind of coal used by factory owners and large buildings. The blanks call for reports on the following kinds of coal: Indiana; Kanawha, W. Va.; Pocahontas, W. Va.; Ohio, Kentucky, Illinois, Pittsburg, anthracite. The Board of Trade committee says it is the intention to gain official information which will show to some extent just what kinds and grade of coal are responsible for the great quantities of dense black smoke in Indianapolis. A meeting was recently held at which the Board of Trade, coal operators and manufacturers decided to investigate smoke conditions, and the steps now being taken are the result of that meeting.

Rawhide, Nevada

By Algernon Del Mar*

The financial depression which caused the suspension of some mines, the strike at Goldfield and other causes have resulted in an unusual amount of prospecting in Nevada during the past winter. The consequence has been discoveries of gold along a belt extending from Lincoln to Humboldt county and such places as Gold Circle, Oro City, Jessup, Rawhide, Banyard and Seven Troughs will quickly become familiar.

The district near Hart, although in San Bernardino county, California, may be considered as part of this belt. The more promising deposits of gold-bearing ground lately discovered are those at Hart, Gold Circle and Rawhide, the last named leading.



RAWHIDE IN JANUARY, 1908

Discovery of Rawhide

Rawhide, like many others, was a chance discovery by men whose business was farming and not mining. It is near a stage road that had been used by prospectors and freighters for the last 40 years. Looking at these deposits with the eyes of experience, one wonders why this ground should have been so persistently overlooked. A very little prospecting would have found visible gold in many places on Balloon hill, the porphyry is stained with red and yellow oxides of iron and the contacts are very noticeable.

Geological Formations

Generally speaking, the formation at Rawhide is a brecciated quartz porphyry, originally, possibly, an andesite breccia, but so altered as to have lost its identity. The ore is sometimes quartz, quartz porphyry, silicified rhyolite, or kaolinized porphyry. The deposits at Rawhide show little or no copper stain, although three miles east, on a contact with a lime belt, both copper and lead show in quantities; copper is found also, six miles southwest. Silver will probably average one-fourth as much as the gold contents. The ore from appearances is free milling, but owing to the fact that some of the gold is very fine and light, the cyanide process will have to be used for treatment of the tailings.

Value of the Camp

From the exaggerated and flamboyant advertising of the district by interested parties, many people look upon Rawhide as entirely a paper boom. In this they are mistaken, because the surface extent and value of the discoveries show the district to be well worth development. The reports of large bodies of high-grade ore are misleading; the assays are no doubt correct but the sampling is open to doubt.

The question now is: what has actually been uncovered at Rawhide? And the best way to answer this is to divide the district into five belts, and as the main belt is along Balloon, Murray and Grutt hills, this will be the starting point.

The First Belt

From the I. X. L. on the north, to the Big Four lease on the south, is a distance of perhaps a mile and a half. This belt includes the Poor Boys, Grutt hill, Kearn's No. 2 and No. 1 leases. St. Ives lease, Olgivie-Reynolds lease, Murray lease, and the two above-mentioned, as on the ends. On all these claims bodies of good milling ore from 4 to 30 ft. wide have been developed with streaks of high-grade that will run into the thousands, but these occur in such a manner as not to be easily separated from the ore of lower value, so that shipments from these high-grade streaks are likely to be very much below what is currently anticipated. Kearn's No. 2, considered the best lease in the camp, in a 65-ft. shaft and crosscut shows 30 ft. of ore that, when sorted a little, might run $30 a ton, with a streak of high-grade, perhaps 6 ft. wide that may average much higher. While the whole dike at this particular point is good milling ore, it has not yet been proved whether the shaft is on a pipe of ore, or a shoot of ore, nor has the probable extent of the shoot been shown. I mention this, not to disparage the property, but only to put the facts in a clear light. Deposits in this character of ground often run in pipes

*Mining engineer, New York.

or lenses and until it is proved otherwise, there is a basis for at least a reasonable doubt whether these values will hold over any extent of ground. This condition applies to many of the deposits at Rawhide, but at the same time it is only fair to consider that there has not been sufficient work done to prove or disprove any theory positively.

To the east of Balloon hill, little work has been done except immediately on its east side, but nothing of any consequence had been developed up to a recent date.

The Third Belt

To the west of this zone, about a mile, is another zone that looks promising for large bodies of milling ore. The best known properties in this vicinity are the Royal, Tiger, Wonder Kings and the original Regent claims. Here we see wide porphyry dikes altered to quartz porphyry. There are some rich streaks reported, but the main bodies are of milling grade. Leasers have been so anxious to be near town that the possibilities of this portion of the district have been somewhat overlooked.

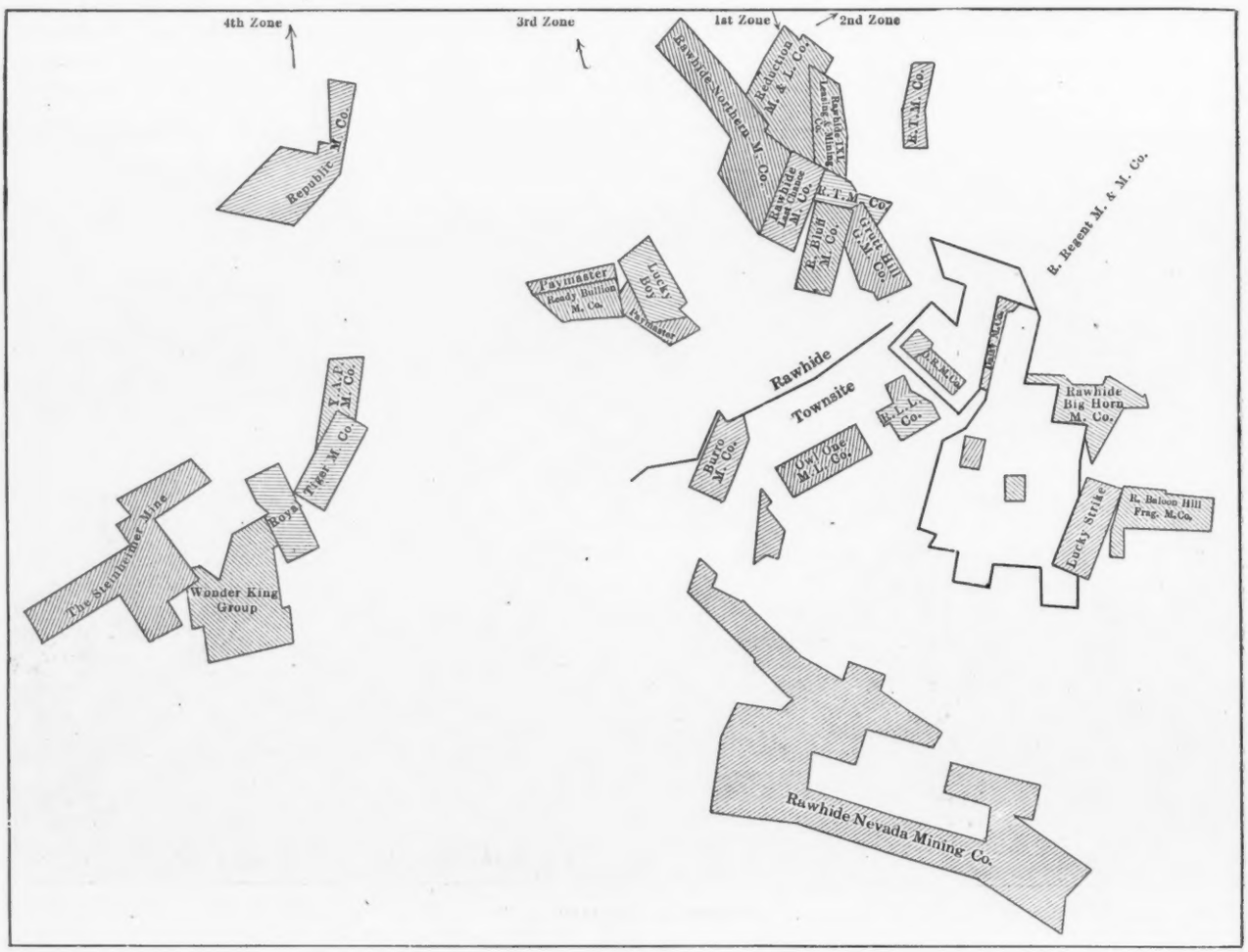
The Western Belt

The last belt to be considered is that on which the Reward and McMann groups are situated, about a mile further west. Here we have a replacement vein of quartz in a porphyry dike, which will produce a good grade of milling ore with perhaps but little high-grade.

To the south and west of this last zone, are dikes of low-grade milling ore, \$3 to \$5 a ton, which under present conditions are unavailable.

General Conclusions

The points made are these: Firstly, that Nevada is to be the center of attraction of the mining world this year, on account of the many recent discoveries of gold-bearing ores; secondly, that Rawhide is among the richer of its new camps; and thirdly, that it will prove to be a good milling and not a shipping camp,



LOCATIONS ON THE PROVED ORE ZONES, RAWHIDE, NEVADA

McCloud Hill

To the west of Balloon hill about half a mile is McCloud or Happy Hooligan hill. The formation in this zone is different from that of Balloon hill, being dacite instead of porphyry. So far as developed, the veins are very small and rich. I do not think the ore taken out has paid for the work done. There are exceptions to this, particularly on the Owl leases, where the veins are wider than on the hill. It is possible that with depth these stringers may extend into the formation sufficiently to produce bodies of good milling ore. The walls of these stringers are the best defined in

as one might be led to believe from newspaper reports.

The accompanying map gives the principal locations in the district, including those mentioned above. The photographs show Rawhide as it appeared about Jan. 1 and again about March 1; a view of Grutt and Balloon hills, illustrating the general topography; and the Murray lease, a typical working of the camp.

In deep hoisting, the following types of drums are used: the Koepe system, its modification, the Whiting system, the conical drum and the reel or flat-rope drum.

British Pig Iron Production

The British Iron Trade Association reports the production of pig iron in the United Kingdom for the second half of 1907 at 4,729,144 long tons, a decrease of 465,568 tons, as compared with the first half. For the full year the production is given as below, in long tons:

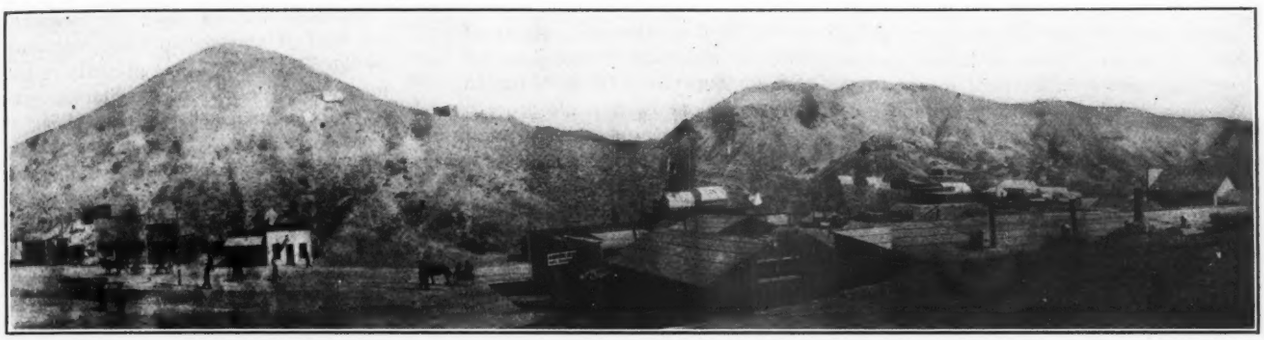
	1906		1907	
	Tons.	PerCt.	Tons.	PerCt.
Foundry & forge..	4,587,606	45.2	4,512,985	45.5
Hematite (bess'er)	3,990,820	39.3	3,776,797	38.0
Basic.....	1,263,317	12.5	1,406,038	14.2
Spiegel, ferro, etc.	307,645	3.0	228,036	2.3
Total.....	10,149,388	100.0	9,923,856	100.0

There were decreases last year of 74,621 tons in foundry and forge iron; 214,023 in hematite; 79,609 in spiegel and ferro; and an increase of 142,721 tons in basic pig. The total loss last year, as compared with 1906, was 225,532 tons, or 2.2 per cent. As compared with 1905, there was an increase of 331,119 tons, or 3.5 per cent.; with 1904, an increase of 1,361,198 tons, or 15.9 per cent.

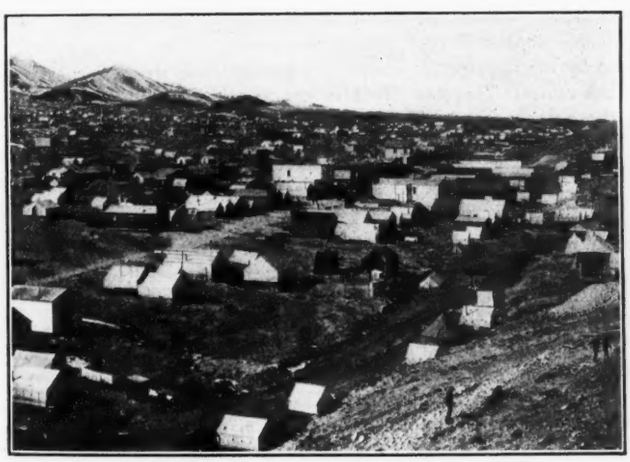
Of 507 furnaces standing the average number in blast was 368 in 1906, and 366 in 1907. The average yearly output per furnace was 27,598 tons in 1906, and 27,096 in 1907; a decrease of 502 tons. By districts, the larger yearly makes in 1907 were 46,726 tons in South Wales and 40,224 in the Cleveland district; the smaller were 16,132 in Scotland, and 14,213 in Derbyshire.

A feature in last year's production was the gain in basic pig, when there were decreases in all other kinds.

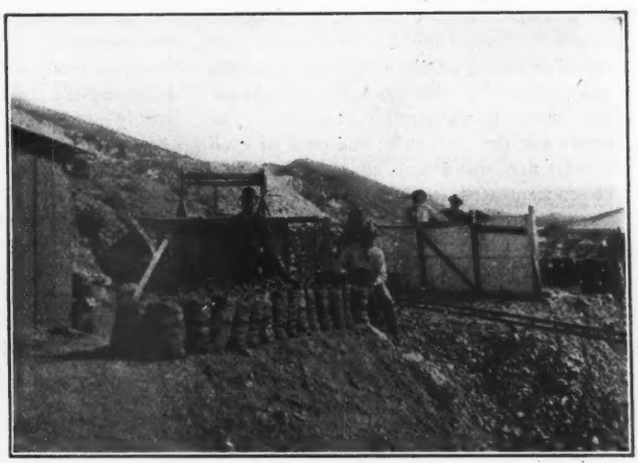
There was a remarkable decrease in the stocks in public stores, which were reported at 730,752 tons on Dec. 31, 1906, and 221,885 at the end of 1907. The decrease of 508,867 tons was 283,335 tons more than the loss in production. It does not follow, however, that consumption was greater last year than in 1906. The decrease in iron in stores was partly due to the fact that the use of public stores and warrant trading are on the decline, and more iron is stored in furnace yards.



BALLOON HILL AND GRUTT HILL, RAWHIDE, NEVADA



RAWHIDE IN MARCH, 1908



MURRAY LEASE, RAWHIDE

Portland Cement Production in 1907

The following statement, issued by the United States Geological Survey, shows the total production of portland, natural-rock and puzzolan cements in the United States for the calendar year 1907.

This statement is issued in advance of the annual report on the production of hydraulic cement in the United States which is now in preparation, and is based on returns from all the active cement plants in this country.

The total production of all kinds of hydraulic cement in 1907 was 52,230,342 bbl., valued at $55,903,851.

Of the above total quantity of cement manufactured in 1907 in the United States, 48,785,390 bbl. were portland cement, with a value of $53,992,551; 2,887,700 bbl. were natural-rock cement, with a value of $1,467,302; and 557,252 were puzzolan cement, with a value of $443,998.

The total production of hydraulic cement in 1906 was 51,000,445 bbl. valued at $55,302,277. Comparison of these totals with those above given shows an increase in quantity in 1907 over 1906 of 1,229,897 bbl., and in value of $601,574.

Though the production of 1907 shows an increase over that of 1906, it is slight as compared with past annual gains in the cement industry, indicating that the Portland cement production of the United States has now reached a stage in its development where it is directly and promptly affected by general business depression.

An official statement that the cement required for the Panama Canal would be only 4,500,000 bbl. has served to put at rest exaggerated ideas concerning the importance of this work to the cement trade. The further statements that bids for delivery of clinker on the isthmus, would be asked for and that the Government might possibly erect its own cement plant there, are also of interest to existing American plants.

Cost of Lake Superior and Montana Copper

Conditions in the Michigan Mines Are All Unusually Favorable; Costs of Smelting and Refining the Product of the Butte Mines Are High

BY JAMES RALPH FINLAY*

The Lake Superior copper mines work deposits of native copper occurring either in beds of conglomerate or in amygdaloids, which mark the upward surface of ancient lava flows. The copper deposits form immense ore-shoots in these beds. The dimensions of the shoots have been proved in one case to be as great as three miles in length and over a mile in width on the plane of the vein, covering many hundred acres. Such a lateral extent combined with a thickness of from 6 to 30 ft., gives a volume of many million tons of workable material.

Since the persistence and extent of the deposits have long been known, it is established that the controlling factor in the successful exploitation of these mines is the provision of machinery designed for handling large quantities of material for long periods of time. The practice of the last ten years has fixed a cost of about $1,500,000 as necessary for the preliminary development and equipment of a property on a scale commensurate with economy. When this provision has been made, the actual working of the deposits is simple, and presents no difficulties beyond obtaining good administrative results. The mines are dry and safe; the ores of each deposit are uniform in character and can be concentrated easily and cheaply; the smelting operations are reduced to a minimum, the concentrates to be smelted ranging from 1 to 4½ per cent. of the ore milled. Wages are very moderate, being about 25c. an hour; supplies of all kinds are cheap; the country in the neighborhood of the mines is well watered and well timbered; transportation to and from markets is done mainly by water, and is very cheap. The population is vigorous and intelligent, although at least 95 per cent. of the men employed in the mines are of foreign birth, the greater number being Finns, Englishmen, Austrians and Italians.

It may be said, therefore, that not a single factor in the working of the mines is unfavorable. The inclination of the deposits is from 35 to 70 deg., so that in following the ore-shoots the shafts become enormously deep, several of them being in the neighborhood of a mile vertically below the surface. This means, of course, an unusual expense for hoisting and increasing difficulty in working as compared with mining at ordinary depths, but it indicates the extremely favorable conditions prevailing in this district by showing the remarkable persistence of the orebodies. Under present conditions the total cost of mining these ores and marketing the copper is from $2 to $3 per ton.

The ore hoisted at the various mines is shipped to mills on the shore of Lake Superior or its bays. The distance is usually from 10 to 20 miles. The mills concentrate the copper into "mineral" containing about 70 per cent. metal. This mineral is then smelted at plants situated along the shores of Portage lake, an inlet of Lake Superior. The smelting and refining are done by a single process; and ingot copper is produced that needs no further refining, the copper being exceptionally pure and commanding a higher price than any other in the market.

Nature of the Deposits

While in a broad sense the conditions are rather uniform throughout the district, there are three fairly well marked types of deposits whose characteristics impose certain differences of method and cost. One is the conglomerate, of which the only commercially valuable deposit is the great ore-shoot worked by the Calumet & Hecla and the Tamarack mines. This has already produced in the neighborhood of 1,100,000 tons of fine copper from more than 40,000,000 tons of ore, and there remains in sight probably 20,000,000 tons more. This magnificent orebody is about 14 ft. thick; it dips at an angle of 37 deg., and is a hard compact bed of conglomerate overlaid by a trap hanging wall of such a character that it requires timbering.

The amygdaloid deposits are rather numerous and have much in common. There is, however, an important distinction between that of the Copper Range Consolidated Company and the other amygdaloid mines. The ordinary amygdaloids (represented by the Wolverine on the Kearsarge lode and by the Quincy mine) either are, or are assumed to be, homogeneous, in that all of the vein stuff is sent to the mill with a very moderate amount of sorting at the surface. These deposits have yielded from a minimum of 12 lb. to a maximum of 50 lb. of copper to the ton. The rock is softer than the conglomerate, and is more easily milled. The hanging wall is generally firm, so that in some cases mining can be done without any timbering.

The amygdaloid of the Copper Range Consolidated Company on the Baltic lode is somewhat different. The rock is harder than the ordinary amygdaloid and the copper is very apt to be attached to numerous small fissures that traverse the bed. The result of this distribution of value has been the development of an entirely distinct type of underground mining, based on a system of sorting waste out of the vein itself and leaving this waste in the stopes for filling.

The Wolverine Mine

Of these various types the simplest is the kind of amygdaloid mine represented by the Wolverine. This property in common with all others of the Stanton group is very well managed and issues clear and excellent reports. The entire process of mining and realizing copper at this mine is simple. The vein averages about 15 ft. thick. It dips at an angle of about 37 deg.; no timbering whatever is required, but a few small pillars are left. The shafts are sunk mainly in the vein itself, but partly in the footwall a few feet back from the vein. Levels are run at distances of 100 ft. and are opened by what are called "stope drifts," these being a complete section of the vein 25 ft. wide along the plane of the footwall. The cost of running these drifts is $5.68 per foot in excess of the cost of stoping an equivalent amount of ground.

In the stopes themselves, nothing is done except to break the ore with machines. Once broken the ore is caught on a low platform built at the bottom of the stope from which the ore is partly rolled and partly shoveled into the cars. This completes the mining process. The cost of the underground work is less than $1 a ton; 7c. a ton is added for crushing and sorting in the rock house at the surface. Transportation to the mill costs about 16c. a ton and stamping about 22c. General expenses such as superintendence, taxes and insurance, etc., amount to about 22c. more; and smelting, refining and marketing about 29c., making a total of operating expenses of $1.84. Construction work for the last four years has averaged 8c., and the total expenses with construction for the same period have averaged $1.92.

It is to be noticed that in this mine the exploration work is reduced nearly to zero. The whole operation is a straight, uncomplicated matter of handling so much material; and to the handling of it nature has interposed as few obstacles as can be found in any underground mine. There is very little water to pump; there are no complex vein systems to work out, no faults to interrupt the vein and no geological relations to be understood. There is always abundant room to work,

*Consulting mining engineer, 2 Rector street, New York City.

good ventilation, comparatively soft ground and no timbering. While it cannot be denied that the Wolverine is a well managed property which has kept notably clear from extravagant impractical projects of all kinds, it seems fair to say that the low costs obtained by it are not in any way extraordinary, but merely the legitimate result of commonsense methods applied to a favorable set of conditions.

The accompanying table gives such details as are published of the cost of mining in the Wolverine and other properties of the same type. It is to be noticed that the Wolverine is at present the richest of all amygdaloid mines, and that for this reason the cost for smelting is higher than that of any of the others.

CURRENT COSTS, MOHAWK MINING COMPANY, 1906

Rock hoisted	703,771 tons	
Rock stamped	618,543 tons	
Product refined copper	9,352,252 lb.	
Yield per ton stamped	15.12 lb.	
COSTS PER TON STAMPED—		Per Ton.
Underground expense	$578,817	$0.93
Surface expense	56,463	0.09
Rock house expense	45,327	0.07
Transportation to mill	83,952	0.14
Stamping	120,152	0.19
Total	884,712	1.42
Smelting, refining and marketing 17.65 lb. per ton		0.18
Construction, average four years (charged to additional output of 5,000,000 tons in 20 years), 5 per cent. interest, 3 per cent. amortization charged on output of 10,000,000 lb.		0.10
Amortization of $1,350,000 invested in plant on 10,000,000 tons to be mined in 26 years, 5 per cent. interest, 2 per cent. amortization		0.25
Total cost of mining 10,000,000 tons		1.95

Cost of refined copper in New York 11.05c per pound.

The Osceola Consolidated Mining Company publishes no detailed costs, but it realizes about the same yield of copper per ton at approximately the same cost per ton as the Mohawk.

BALTIC LODE

The second type of amygdaloid deposits, represented by the Baltic, Trimountain and Champion mines of the Copper Range Consolidated Company, presents a more difficult problem in operating. The Baltic lode has a dip of about 70 deg. Its hanging wall is insecure, so that it will not stand for any considerable area without support. Moreover, the vein is wide, sometimes as much as 50 ft., and the vein stuff has more the appearance of trap than the ordinary amygdaloid. The great width of the vein would in many cases make the leaving of pillars to support the hanging wall a very expensive and doubtful expedient.

Mining on this lode by the ordinary methods used for amygdaloid deposits was a failure. The whole vein had to be mined in order to find the copper which was scattered somewhat irregularly through the mass; but the whole vein proved to be too low grade to pay. It would yield only about 14 lb. copper to the ton. F. W. Denton solved the problem approximately as follows: The vein as a whole, yielded in the mill 14 lb. copper and probably contained six additional pounds of copper that were lost in the milling process. By picking out waste or low-grade ore in the mine it was found that 40 per cent. that would run no better than the mill tailings could be rejected. This selection yielded the following results: 100 tons mined contained 2000 lb. copper; 40 tons were rejected containing 240 lb.; this left 60 tons of material containing 1760 lb. of copper or 29 lb. to the ton. This when sent to the mill and treated with a loss of 7 lb. in the tailings yielded 22 lb. per ton milled as against 14 lb. obtained before.

Logically this process means additional expense as follows: 100 tons of rock would have to be broken and only 60 tons realized. If to break the whole vein cost 40c. a ton, the breaking of the 60 tons recovered must cost 67c. per ton. This represents about the measure of additional expense involved in the selection process. The coarse waste picked out underground can be piled back as easily as it can be shoveled into cars by the ordinary process and taken to the shaft. Indeed, it is possible that an actual saving is effected in tramming by the use of this system because it is easier to get the rock into a chute than it is to shovel it into a car and the tramming of the rock from the chute to the shaft is practically as cheap as it would be to push the cars to the shaft after they were loaded by hand.

PECULIARITIES OF SORTING AND FILLING METHOD

This method of filling the stopes by rock sorted from the vein itself is a novelty in Lake Superior though not in the mines of the West. Since it was developed independently by Mr. Denton, it resulted in one or two points of practice different from that employed anywhere else.

The rock sorted from the vein is hard and rough, and this fact has been taken advantage of in building up stone walls on the levels instead of using timbered drifts. These stone walls are covered with large timbers and lagging and then the whole thing is covered with the waste filling. It is found that stone walls resist the pressure of the accumulating filling very much better than any timber and in fact maintain themselves in perfect condition as long as they are required. The mill holes leading through the waste to the working faces at the top instead of being built of wooden cribbing are circular wells laid in stone. In building the walls on the

WORKING EXPENSES AT THE WOLVERINE MINE, YEAR ENDING JUNE 30, 1907.

			Per Ton
UNDERGROUND EXPENSES (Rock Stamped 344,062 Tons)—			
Sinking 450 ft. at $17.88		$8,046.00	
Drifting 4,993 ft. at $5.68		28,385.80	
Stoping 23,175 fathoms at $7.69		178,269.70	
Labor		1,546.55	
		$216,248.05	
Timbering		5,286.60	
Tramming		71,603.15	
Mining captains and labor		29,151.80	
Mechanics		7,833.15	
Hoisting and pumping		22,092.51	
Compressor		29,774.52	
Teaming, etc		1,095.95	
Supplies and fuel		19,107.47	
Electric light		291.88	
		$402,584.98	
Less profit on supplies furnished contractors		65,416.00	
		$337,168.98	$0.98
ROCK HOUSE—			
Labor	$13,371.85		
Machinists	1,166.28		
Fuel	2,160.00		
Supplies	3,621.29		
Teaming, etc	808.30		
Electric light	1,167.12		
		22,294.84	0.065
STAMP MILL—			
Transportation	$55,053.35		
Supplies and electric light	9,918.72		
Machinists	4,318.90		
Fuel and teaming	26,816.00		
Labor	27,632.80		
Pumping	7,599.78		
		131,339.55	0.38
SURFACE AND INCIDENTAL EXPENSES—			
Superintendence and labor	$20,309.57		
Supplies	9,523.51		
Telephone, telegrams and sundries	495.28		
Taxes and insurance	48,938.14		
Freight on mineral, etc	5,948.28		
	$85,215.18		
Less amount received for rents	6,547.90	78,667.28	0.223
		$569,470.65	1.648
Construction average of four years			0.08
Amortization of $780,000 at 5 per cent. interest and 3 per cent. annual amortization			0.20
Smelting, refining and marketing			0.284
Total			2.217

Average cost of copper in New York, 7.93c. per pound.

*The amortization in this case includes the purchase price of the property. This item is not distinguished from the capital invested in equipment.

main levels and in the mill holes, advantage has been taken of the presence of Italian and Austrian miners who usually have had experience in laying stone walls in their own country. The total result is a very pretty adaptation of methods to the natural conditions.

The results in dollars and cents obtained by this method are all, and rather more, than could be expected. As compared with the Wolverine we find that in 1905 the underground costs at the Baltic were $1.04 a ton, and in 1906, $1.06 a ton, against $0.93 and $0.98, respectively, at the Wolverine, a difference of about 10c. a ton as against the 27c. increase that we might have expected. The Copper Range mines are, however, less than 1000 ft. deep, while the Wolverine will average more than 2000 ft.; so that the former gets some advantage in costs on this account.

There are certain advantages in the sorting and filling system over and above mere availability. These are: (1) The security of the mine; (2) the fact that no pillars need be left for any reason, unless, indeed, the shafts are sunk in the vein, in which case it is always necessary to leave some ground on each side of the shaft; (3) the system completely solves the question of exploring the vein for its copper contents; enough ground can always be taken to expose stringers and bunches running into the walls.

Costs at Copper Range Mines

Outside of the operations in the mine itself, the Copper Range company does its business much as other amygdaloid mines do; whatever further economies it practices are entirely due to mechanical reasons and the volume of material handled and not to differences in method. The accompanying table gives the results obtained in recent years.

COSTS OF MINES OF THE COPPER RANGE CONSOLIDATED COMPANY, 1906.

	Baltic.	Champion.	Trimountain.
Tons stamped	649,932	671,785	506,942
	Per Ton.	Per Ton.	Per Ton.
Superintendence and labor	$0.79	$0.86	$1.05
Rock house	0.07	0.10	0.08
Hoisting	0.06	0.05	0.09
Power drills	0.06	0.07	0.07
Timber and supplies	0.15	0.16	0.14
Surface costs	0.06	0.08	0.07
Transportation to mill	0.17	0.14	0.11
Stamping	0.18	0.22	0.21
Smelting, refining and marketing	0.25	0.32	0.23
Total operating	1.79	2.00	2.05
Taxes	0.07	0.09	0.08
Construction, estimated average	0.10	0.10	0.10
Average current costs	1.96	2.19	2.23
10,000,000 tons to be mined in 26 years from time of investment at 5 per cent. interest and 2 per cent. amortization	0.15	0.27	0.22
	$2.11	$2.46	$2.45
Recent yield copper per ton	22 lb.	25 lb.	19 lb.
Current cost copper per lb	9c	8⅞c	11.7c
Cost, of copper per pound in New York	9¼c	9⅜c	12⅛c

Tamarack and Calumet & Hecla

The third type of Lake Superior copper mines is represented by the Tamarack and the Calumet & Hecla. The record of these properties shows very clearly that the conglomerate is a more difficult and expensive problem than the amygdaloid. The deposit has the advantages of remarkable uniformity and continuity; but as compared with the amygdaloid, the conglomerate has three features that substantially increase the cost of working: (1) The richness of the ore has averaged 2½ times as great as that of the characteristic amygdaloid; consequently the cost for smelting has been 2½ times as great, and this fact has meant an increased cost of not far from 50c. a ton. (2) The conglomerate is much harder, tougher and more difficult to handle. It breaks in rough, ugly chunks which wear out the tram cars, bin linings and stamp shoes very rapidly. Its greater hardness is reflected by the fact that the mills will handle 40 per cent. more amygdaloid than of conglomerate. This characteristic in itself is probably sufficient to add in the neighborhood of 20c. a ton to the cost of handling, breaking, tramming, crushing and milling this ore. (3) The hanging wall is loose and the mines need constant and expensive timbering. This item has added from 25 to 75 c. a ton to the cost.

The total of these increased costs may be reckoned at, in round numbers, $1.20 a ton. The above figures have reference to the average conglomerate ore as mined to date which has contained not less than 55 lb. copper to the ton. At present the Calumet & Hecla is yielding only 42 lb. a ton while the Tamarack is yielding only 23 lb. On the present basis, therefore, the smelting costs are somewhat lower than they would be for an average of this class.

Results and Costs at the Tamarack

Up to July 1, 1893, the Tamarack mine had produced 84,000,000 lb. copper from 1,400,000 tons of rock, an average of 60 lb. per ton. The cost for operating was $5,816,083, or $4.15 a ton. Construction on the original mine from which this ore came was 68c. a ton additional. The total cost had, therefore, averaged $4.80 per ton. In 1892-3, 345,925 tons were stamped, yielding 46.43 lb. per ton. The costs were:

Underground mining	$1.69
Rock house, surface and stamping	0.77
Smelting	0.82
Total operating	3.28
Construction on old mine	0.04
Construction on new shafts	2.14
Total	$5.46

By 1899 the costs were:

Total operating	$3.50
Construction	0.63
Total	$4.13

By 1904 the costs had become:

Mining and stamping	$2.42
Smelting and general	0.61
Total	$3.03

Of late years a good deal of amygdaloid has been mined.

Since 1904 the operations on the Tamarack have been very much interfered with by a serious underground fire and other difficulties and delays. It is probable that the above figures give a fair idea of the results obtained. The item of construction has been very heavy indeed. It is accounted for by the sinking and equipping of five very deep and expensive shafts. It appears that up to 1899 the output of the Tamarack had been about 4,400,000 tons, produced at a total cost of $17,600,000, or $4 a ton. The resulting product was 195,000,000 lb. copper, or an average of about 44.3 lb. to the ton, the cost of fine copper being about 9c. a pound.

Calumet & Hecla

The Calumet & Hecla has been a rich mine and its costs have been somewhat higher than were strictly necessary. For the last 10 years it seems that the costs have averaged a little over $4 a ton, but since the company issues no detailed reports, it is possible to make only an approximation. This cost does not appear at a disadvantage compared with the Tamarack, for while the Tamarack ores average about 44 lb. copper per ton, those of the Calumet & Hecla have averaged 50 lb.; and while it is true that the Tamarack has expended large sums on new construction and development, it must not be forgotten that the Calumet & Hecla has done the same thing during the same period. At present the Calumet & Hecla is mining an increasing proportion of amygdaloid from the neighboring Osceola and Kearsarge lodes to the eastward of the conglomerate.

It appears that the conglomerate workings as compared with a representative amygdaloid mine like the Wolverine would appear somewhat as follows:

Underground factors making for increased cost are: the very great depth, averaging more than 4000 ft. vertically; the considerable heat, averaging about 80 deg.; the necessity of timbering, which in itself accounts for at least 30c. a ton; the hard angular character of the ore which renders shoveling, tramming and handling more difficult and expensive; and finally, the difficulty of maintaining the deep inclined shafts under a weak hanging wall.

It does not seem unreasonable to appraise these factors at 50c. a ton, at least, excess cost over that of the amygdaloid mine of moderate depth. The cost of milling the ore should be approximately 15c. a ton greater. While the cost of smelting 42 lb. fine copper per ton as against 22 lb. should be 25c. more. To sum up it appears that mining costs representing the two types should compare about as follows:

	Amygdaloid.	Conglomerate.
Underground expense and rock house	$1.10	$1.60
Transportation and milling	0.40	0.55
General expense	0.22	0.22
Smelting, refining and marketing	0.25	0.50
Total	$1.97	$2.87

Judging from the decreased cost shown by the last few annual reports and estimating the effect of the recent cut in wages, I hazard the guess that this mine is achieving costs approximately as here given.

Copper Mines of Butte, Mont.

The external factors of mining cost in the Butte district are unfavorable. The district is situated on a semi-arid plateau at great distances from the important industrial centers of North America; in a region containing, it is true, supplies of fuel, timber and water for power purposes, but these supplies are in every case situated at considerable distances from the mines and under conditions not favorable for cheap delivery. Most of the mining supplies and all of the copper product must be shipped long distances overland on railroads operating in sparsely populated districts with high gradients and high operating costs. The freight by rail, for instance, on copper from Butte to New York is at least six times as great as the rate by water from Lake Superior to New York.

The labor employed in the Butte mines is vigorous, intelligent, and, under normal conditions, abundant; but on the other hand, the wages are the highest paid in the United States, if not in the world, for any considerable volume of labor. Up to 1901 the average wages paid were 37c. an hour. Since 1901 they have averaged 47c. an hour, these figures being compared with 25c. an hour for Lake Superior. It is indeed probable that the Butte miners are better and more effective than those of Lake Superior, but hardly to the extent required to make up this great difference. Under present conditions, wages in Butte are nearly 100 per cent. higher than in Lake Superior. It seems unreasonable to estimate that more than half of this difference can be made up by superior efficiency in Butte, so that in round numbers we shall have to estimate labor costs in Butte as at least 50 per cent. higher than in Lake Superior.

One unfavorable factor which may be classed as external is the location of claims under the apex law. This has meant the parcelling out of the surface in small, irregular and conflicting fragments, and this fact has interposed a serious obstacle to the comprehensive development and working of the mines. In this respect Butte does not perhaps suffer by comparison with other mining districts in the Rocky mountain region; but as compared with Lake Superior, this arrangement must be classed as a pronounced disadvantage.

Internal Factors

The internal factors in the Butte mines are not unfavorable for fissure vein deposits, but they present certain characteristics which make for increased costs as compared with Lake Superior. The ores all come from an area of about two square miles, and from this area the output of copper and silver has been simply prodigious. This is a favorable feature.

The veins, according to H. V. Winchell, belong to three different systems. Of these the first and oldest, called the Anaconda system, strikes east and west and dips to the south. The filling of these veins is quartz and pyrites in which the original proportion of copper was probably small. These veins are intersected by mineralized fault fissures striking northeast and southwest, and both these systems are intersected and faulted by a third system of mineralized fissures running northwest and southeast. In addition to these veins, still later barren faults of considerable displacement intersect all the orebodies.

The result is a great complexity of vein structure which has proved a serious problem to unravel. As might be expected the various faults are accompanied by considerable zones of crushing and alteration which add considerably to the difficulty of mining. An additional complexity is brought in by the influence of a pronounced reconcentration of values due to surface oxidation and leaching and subsequent deposition at greater depths. While it is true that in a great measure the orebodies owe their commercial value to this reconcentration, it is also true that it has resulted in an uneven distribution of the ore which imposes a necessity of sorting and is a factor of additional cost. The upper 200 or 300 ft. of the veins is absolutely barren.

The oxidation of the large bodies of pyrites and the decomposition of vast quantities of timber in these mines has resulted in the generation of an unpleasant degree of heat. The temperature must be kept down by very thorough ventilation. Here we have a factor that makes for additional cost.

Method of Treatment

The process of mining in Butte is conducted about as follows: The ore is hoisted from the mine and dumped directly into large bins from which it is drawn into railroad cars and transported to combined concentrating and smelting plants. A small proportion goes to plants in the vicinity of Butte itself, and not more than two or three miles from the mines, but by far the greater portion is taken to Anaconda 26 miles away, or to Great Falls 100 miles away. At the smelters all ores containing less than 6 per cent. copper are concentrated. The higher-grade ores are smelted in blast furnaces and the concentrates in reverberatory furnaces collecting the metals into a matte which is bessemerized on the ground into blister copper. A portion of this blister copper is refined at the Great Fallls plant but by far the greater portion is shipped to the Atlantic seaboard in the neighborhood of New York and there refined. Nearly all the copper output of Butte is sold through the agency of the United Metals Selling Company.

The most pronounced factor making for high costs in the Butte ores is the large percentage that must be smelted. This can be estimated roughly at 40 per cent. as against 4 per cent. for the richest copper ores in Lake Superior.

The concentrating and smelting are largely done in two immense plants owned by the Amalgamated Copper Company, one at Anaconda, and the other at Great Falls. It is believed that these plants are equipped and operated as well as any in the world, no pains having been spared in capital expenditure to secure the greatest economy. But it is manifestly a physical impossibility to smelt 15 to 30 tons of ore at Butte for anything like the cost required to smelt one ton of concentrates in Lake Superior. Furthermore, the Butte copper must stand not only a very heavy transportation expense to the seaboard but must further undergo the expensive process of electrolytic refining. The logical result of these conditions is that in Butte $4 a ton for concentrating,

APPRAISEMENT OF COST FACTORS AT ANACONDA AND AT CALUMET & HECLA.

	Calumet & Hecla.	Anaconda.	Difference against Anaconda.
Costs at Mine—			
Stoping labor	$1.10	$1.65	$0.56
Exploration	.....	0.30	0.30
Supplies including Timber	0.50	0.90	0.40
General expense	0.22	0.50	0.28
Total	$1.82	$3.35	
Construction and amortization	0.25	0.25	
	$2.07	$3.60	+$1.53
Outside Costs—			
Freight to mill	$0.15	$0.15	
Cost concentrating	0.55		
Cost smelting		2.90	+$2.35
Cost of refining and marketing	.50	1.21	+ .71
Total cost	$3.12	$7.71	+$4.59

Percentage milled, Calumet & Hecla mine, 100.
Percentage smelted, Calumet & Hecla mine, 3; Anaconda mine, 45.
Pounds copper to ton, Calumet & Hecla mine, 42; Anaconda mine, 63.

smelting and refining may be considered as an absolute minimum as against a cost of from 60c. to $1 in Lake Superior.

Mining in the Butte District

It is not my intention to go into the details of mining practice further than to point out the general characteristices that determine the costs, but it may be pertinent to mention in a general way the methods in use underground. The Butte ore is all opened by vertical shafts which at present have attained depths of from 1800 to 2800 ft. Levels are run out at intervals of 100 to 200 ft. A large amount of work is necessary to discover and develop the ores and many thousand feet of exploring drifts and crosscuts must be run through country rock in pursuit of the various ore shoots. Here is an item estimated at 30c. a ton for exploration work that is quite absent from the prominent Lake Superior copper mines.

In stoping, the walls are found to be soft enough to require constant timbering, usually by square sets. In many places the effect of the faults above mentioned has been to produce rock so soft as to make the timbering especially difficult and expensive. As a rule the stopes require, in addition to the timbering, a rock filling for safety. This filling is obtained mainly out of exploring drifts and to some extent from the surface, but also in some cases it has been found necessary to make rooms in the country rock for the mere purpose of securing waste filling. It does not appear that a great deal of waste is sorted for filling out of the vein itself, although it suggests itself to the casual visitor that this is a point that might be gone into rather seriously. Since the cost of transportation, concentrating, smelting, refining, and marketing amounts to at least $4 a ton, it would seem as if the point at which ore already broken would better be left in the mine than treated, is about 1¼ to 1½ per cent. copper.

All the mines of Butte are run on the same principle; when you describe one you describe them all. I select the Anaconda mine as a basis for comparison with the Calumet & Hecla in Lake Superior, not for the purpose of drawing any invidious comparisons of management, but for the purpose of calling attention to the factors which I believe establish the costs per ton. In such a comparison it is of course, absurd to lay claims to accuracy, but since the object of this discussion is to find out why costs are different in different places, it seems proper to enumerate what reasons one may see.

The accompanying table shows the reported costs for the various mines at Butte since the year 1903. Two facts are worth noting: First, that the cost for mining proper has tended to rise, probably on account of an increased proportion of development work undertaken in recent years; second, that the cost of reduction and also of refining and marketing have come down notably. This reduction is probably due to the great metallurgical improvements that have been effected by reason of the liberal policy of the Amalgamated Copper Company in its expenditures to provide better smelting facilities and also its good management. A further reason for diminishing costs in smelting, refining and marketing is a diminution in the metallic contents of the ore, a greater amount being concentrated and a less amount being smelted and refined per ton. In the case of the Boston & Montana a considerable saving has also been effected in transportation costs.

COSTS AT MONTANA COPPER MINES.

	Tons.	Mining Per Ton.	Freight to Smelter Per Ton.	Reduction Per Ton.	Refining-Marketing Per Ton.	Total Cost Per Ton.
Anaconda Copper Company. (Transportation to Anaconda 26 miles.)						
1903	1,392,835	$3.49	$0.15	$3.39	$2.30	$9.33
1904	983,001	3.73	0.15	3.82	1.96	9.66
1905	1,473,644	3.56	0.15	3.00	1.11	7.82
1906	1,521,310	3.63	0.15	2.27	1.08	7.13
1907	1,401,948	4.47	0.16	2.52	0.93	8.08
Boston & Montana. (Transportation to Great Falls.)						
1903	907,227	$2.61	$1.00	$3.05	$2.90	$9.54
1904	988,866	2.89	1.00	2.53	1.81	8.23
1905	1,138,307	2.91	1.00	2.21	1.69	7.81
1906	1,209,805	3.45	0.93	2.45	0.90	7.73
1907	1,156,785	3.93	0.76	2.67	0.92	8.28
Butte & Boston. (Transportation to Anaconda.)						
1903	245,333	$3.27	$0.16	$2.44	$1.12	$6.99
1904	202,286	3.42	0.17	2.67	1.05	7.31
1905	260,433	3.31	0.19	2.45	0.79	6.74
1906	246,593	3.51	0.20	2.06	1.25	7.02
1907	331,629	3.79	0.21	2.27	0.85	7.22
Butte Coalition.						
1906	149,101	$3.94	$0.60	$3.94	$1.50	$9.98
1907	412,169	5.49	0.29	2.29		
North Butte.						
1906	259,650	$4.47	$0.20	$4.84		$9.51
1907	374,632	4.53	0.20	4.04		8.77

It is to be noted that the Butte & Boston ores have cost less than the others. This is undoubtedly due to their lower grade, the proportionate cost for smelting, refining and marketing being less. On the other hand, the North Butte has cost more on account of its higher grade and Butte Coalition has cost more than the average on account of the large expenditures for improvements.

The Ozark Zinc Oxide Works, Coffeyville, Kan.

The works of the Ozark Smelting and Mining Company, at Coffeyville, Kan., has a capacity of 125 tons of ore per day, manufacturing zinc oxide and zinc-lead pigment. The plant is divided into two units, each of which can be employed independently.

Ore is unloaded into a 20x10-in. Blake crusher which discharges into a Gates elevator and is carried to the top of the building and discharged into a revolving screen, having ⅝-in. openings, the oversize from which goes to a set of 36x12-in. crushing rolls on the second floor. The ⅝-in. material is discharged into a second trommel with ¼-in. openings, the oversize going to another set of 36x12-in. crushing rolls on the first floor; it is then returned to the crushing rolls on the second floor, after passing to a mixing drum which discharges into a Vezin sampler. The crushing machinery, including elevators and screens, was furnished by Allis-Chalmers Company, Milwaukee. A 75-h.p. induction motor drives the crushing section. Storage bins for crushed ore, are arranged to be emptied from beneath into cars.

The roasting is done in two 5-hearth Allis-Chalmers McDougall furnaces, each 18 ft. by 16 ft. high, and driven by a 25-h.p. induction motor. At a later date two 6-hearth A. C. McDougall furnaces were added each 18 ft. by 19 ft. high. They are fired by natural gas. These furnaces have a capacity of from 25 to 35 tons each per day. Roasting reduces the sulphur content of the ore to 3 per cent.

There are two blocks of oxide furnaces, each block containing 18 furnaces 6x12 ft. The blast, furnished by two fans driven by a 30- h.p. motor, is carried to the furnaces by a large underground conduit and discharged under the grate. The furnace is controlled individually by means of a drop grate.

The fumes are drawn from the furnaces by a large exhaust fan located in the bag room. The fume first enters a chamber wherein the carbon is all burned out and the dirt is allowed to settle. It is then drawn through 600 ft. of cooling pipe to lower its temperature. Then it enters the fan and is driven to the bag room. The fume first enters the lateral pipe and thence is distributed to 18 pipes each with 17 hoppers on which short bags are tied reaching to the floor. Oxide is shaken down into the short bags which are removed every 24 hours and dumped into a conveyer which carries them to the packing room. Oxide is packed 400 lb. in a barrel.

The power plant comprises two 180-h.p. boilers fired by gas, and one 250-h.p. Corliss engine, direct connected to an alternating current generator of 150 kw. capacity. The design for this plant was laid out by Allis-Chalmers Company, Milwaukee.

The amount of slag, formed in refining bullion from zinc-box precipitate, depends upon the amount of impurities in the precipitate. The losses in refining mainly arise from the gold going into the slags; therefore every precaution should be taken to prevent the contamination of the sludge. The cyanide solutions should be clarified before entering the precipitation tanks so that fine grains of silica or of ore shall not become mechanically mixed with the precipitate. Sometimes calcium carbonate, calcium hydrate, magnesium hydrate and less frequently calcium sulphate give trouble by forming crusts in the zinc boxes.

The Eight-hour Bill as Related to English Coal Mining

By George Raylton Dixon

By the time this article appears in print, the British Home Secretary will probably have brought before Parliament, "A Bill to Amend the Coal Mines Regulation acts, 1887 to 1905, for the purpose of limiting hours of work below ground."

Interference by legislation must always be of interest to mineowners and managers, whether they are directly concerned or not. I intend, as briefly as possible, to make readers of the JOURNAL acquainted with the conditions which the act proposes to amend, the difficulties which have to be overcome in its application, and my own solution of those difficulties.

Colliery owners and consumers are loud in their denunciation of the measure, contending that not only will the cost of production be greatly increased, but that the output will be seriously decreased. This is admitted in some measure, by the supporters, but they assert that the country should not f ar to pay for the great good that would accrue to the boys employed in coal mines. A "boy" in the Coal Mines Regulation acts, is a male below the age of 16. As applied above, it refers to a male below the age of 21 years. The mineowners assure the country that the mine workers are well capable of looking after themselves.

The Miners' Federation of Great Britain has again and again signified its approval of an 8-hour day. The miners of Northumberland and Durham have been opposed in the past to legislation in this respect, believing the present system, in vogue in their coalfield, to be necessary to the proper carrying on of their peculiar trade.

The difference of opinion on this point was the principal factor that prevented them joining the federation. At last, however, the miners of the northern counties have changed. In this and other matters they have thrown in their lot with the Federation.

The Conditions Peculiar to Northumberland

The coal in Northumberland is hard, and difficult to get. It is shipped as a steam coal; hence it is important that it should be in large pieces. Small coal is of much less value than large coal. The labor is specialized: The "hewer" gets coal and does nothing else. "Stonemen" and "shifters" do repairing and cleaning up work. "Putters" convey the cars between the hewers in the face, and the collecting and distributing station, called "the flat."

Sometimes the putters push the cars themselves, but oftener they drive a pony. "Drivers," convey the cars in sets to the "landings" of the main haulage system. "Rolleywaymen" and "lads," work the system of mechanical haulage. Surfacemen will not be affected by the act, so need not be particularized. Of the total mine workers, about 84 per cent. work below ground, and 16 per cent. above ground. The underground workers are divided as follows: Hewers or getters, 50 per cent.; officials and deputies, 2 per cent.; stonemen and shifters, 25 per cent.; total 77 per cent. These all work now 8 hours or less and so will not be affected. Other underground workers are classified as follows: Rolleywaymen and lads, 9½ per cent.; putters, 7 per cent.; drivers, etc., 6½ per cent.; total 23 per cent. These work 10 or 11 hours, and are the persons who w'll be affected by the bill. Fig. 1 shows the hours worked by the above classes of labor at a colliery drawing coal for 11 hours.

The winding engines and sorting plants are laid down at the collieries for dealing with the coal over this period, and the same quantity could not be dealt with in a shorter period. It will be seen from Fig. 1 that the arrangement underground is to have two shifts of hewers to one of the other classes. This system has been evolved out of experience, and works admirably. The coal is obtained by blasting, and preparatory to placing the shot there is a great deal of hard work. The coal must be "nicked" and "kirved," so that when the shot is fired there will be three free faces. The coal is thus broken in large pieces.

The fore-shift of hewers goes in 3½ hours before the putters, so that they may get some coal ready for filling. They are relieved in the face by the back-shift hewers, so it is evident that the length of the fore-shift hewers' shift depends on the distance of the place from the shaft bottom. The average length of a hewers' shift may be taken at 7½ hours from bank to bank.

"Stonemen" and "shifters" reckon on working an 8-hour shift, and if they work more than 8 hours are, of course, paid pro rata. Stonemen often do piece work, and they remain until they can leave the places in a satisfactory state. Thus, when they fire a shot, they might easily get down more stone than they reckoned on. Naturally they stay in the pit from 30 min. to an hour, until they have finished clearing and packing the stone. The bill will put a stop to this, and the earning power of the men will be reduced. I think Mr. Gladstone might have left a clear ground for private arrangement with grown men. The Miners' union strongly disapproves of men remaining underground, and I think some license in this respect would not be abused. However, in justice to the framers of the bill, they do provide for emergencies, and it must be admitted that without some such record as is provided for, the extent to which men remain beyond their assumed length of shift, could not be known to those who have a right to know.

Now, with regard to those who will be materially affected by the bill: The rolleywaymen and lads and the drivers are down the pit a long time, but their work is not hard, and it is done generally under good conditions. Apart from the fact that in certain months of the year they only see the light of day at the week ends, there is nothing in their conditions of labor that calls for special sympathy or treatment. "Putters" have really to work hard; it is argued that the length of time a miner puts, is only a small proportion of his life underground, and that being so, he might reasonably be asked to work

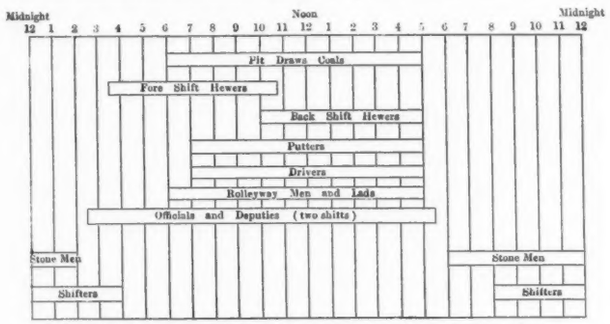


FIG. 1. CHART SHOWING ARRANGEMENT OF LABOR UNDER PRESENT CONDITIONS

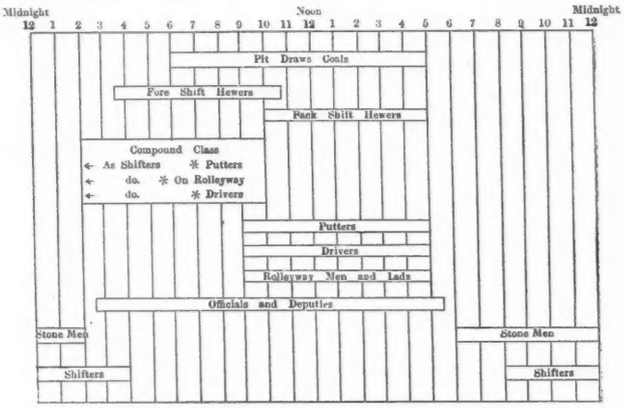


FIG. 2. CHART SHOWING ARRANGEMENT OF LABOR WITH AN EIGHT-HOUR DAY

10 hours daily. In opposition to this it must be stated that the age of putters is between 16 and 22 years, not a time in life when physical endurance should daily be tried to the utmost. I have no hesitation in saying that many a man has had his constitution undermined, and his capacity for work and enjoyment of life thus reduced for the rest of his life, by overtaxing his strength at this critical age, when the physical resources should be husbanded, and not abused. It is because the Northern miner has come to appreciate the view set out above, that he has become a supporter of the present bill. The economic conditions which require the physical abuse in any trade of even 7 per cent. of the workers, might well be called in question.

I did not undertake the preparation of this article to convert anyone to a belief in the necessity for this bill, but to place all the facts before readers of the JOURNAL, consequently it is right to state some further particulars about the time spent in working by miners. It must be said that as a class, they are fond of holidays, and when wages are good a great deal of time is lost. This is perhaps especially so with the boys. Often, the overman of a pit finds great difficulty in working on a Monday, due to the large number of boys who are absent. He must then call out hewers or getters to do their work, and pay them high wages. The working cost of the day is, therefore, increased, while the output is decreased, as compared with a normal day. In a way, the bill proposes to do this every day, and so without doubt, under its operation, the cost will be increased, and production lessened.

The pits work only 11 days each fortnight. In one year the miner does not work on 52 Sundays, 26 Saturdays, and seven odd holidays, a total of 85 days.

Often additional days are lost due to bad weather, with consequent delay of shipping; and if a fatal accident occurs, the pit is stopped on that day, or if the fatality occurs late in the day, the pit does not work on the next day.

The number of days a miner can work may be set down at 275 to 280 days in a year. As previously stated, he seldom works all the days he can; when he has money in his pocket he makes a holiday. I have stated above the proportion of workers engaged in the different operations underground. Out of 1000 persons employed the numbers would be: Hewers or getters, 500; officials and deputies, 20; stonemen and shifters, 250; putters, 70; drivers, etc., 65; rolleywaymen and lads, 95; total, 1000.

The question now arises, how will these workers be proportioned out under any scheme to meet the new requirements? It is evident that the proportion they bear to each other will be quite different.

PROPOSED NEW SCHEME OF WORKING

I would suggest that there be two shifts of hewers as at present, working the same time as at present. The time the pit draws coal will remain unaltered. The present shift of putters, drivers, and rolleyway-hands will go in at 9 a.m. instead of 6 and 7 a.m., and so at 5 p.m., will have been 8 hours underground. The work now done by these men and lads between 6 a.m. and 9 a.m. will have to be done by others. These will go in at 2 a.m. and return at 10 a.m. The hour between 9 a.m. when the second shift goes in, and 10 a.m. when the first shift comes out, will be required for traveling in and out. The first shift, before they are required to work as putters, drivers, engine-plane men, etc., will do repairing and cleaning-up work for the master shifter. A number of the stonemen and shifters will go to work as at present.

Fig. 2 shows the proposed arrangement when the act has come into full force. If the output has to be kept up to its present level, the number of persons required will be as follows: Hewers, 500; officials and deputies, 20; stonemen and shifters, 135; a compound class, including half shifters, half putters, drivers, etc., 230; putters, 70; drivers, 65; engine-plane men and lads, 95; making a total of 115. A comparison of this summary with the preceding one will show how it has been made up. There is an increase of 115 hands in every 1000 for the same output. It is evident that these extra men will not be easily secured.

The bill does not make a sudden jump to this condition. At first, the hours of employment of those working more than 8 will not be reduced to 8, but to 9 hours. It is not until July 1, 1910, that the regulations proposed by the bill come into full force.

Assuming that the extra hands required to keep up the present output cannot be secured, out of every 1000 persons employed below ground there will be: Hewers, 449; officials and deputies, 18; stonemen and shifters, 121; compound class, half shifters, half putters, etc., 206; putters, 63; drivers, etc., 58; engine-plane men and lads, 85; making a total of 1000. The important point is that the number of getters is reduced by 51, or 10 per cent., and this is the amount by which the output will be reduced. That is always assuming that in the meantime, more laborers are not attracted to the collieries.

There can be no doubt that the change will bring about high prices for coal, and this period will afford a good opportunity in the coal trade itself, for the adjustment of the inevitable difficulties between the coalowners on the one hand, and the workers on the other. The nature of these difficulties will be evident. Quite a large proportion of the hewers or getters must change their occupation, and then can they expect to retain the same standard of wage? By what means will it be decided as to who will remain getters and who will change? When men do boys' work, what wage can they expect? Can the men and boys who work 10 hours, expect to get the same wage for working 8 hours?

I suggest that if a man is engaged at two classes of work in a shift, his efforts will not be so productive as if only engaged at one class of work. Again, it will be difficult, at first, to get together a suitable class of men for the compound class. In the last summary I gave a possible proportioning of men, and I showed only one compound class. It is probable that there would have to be two. One would contain men who would divide their attention between hewing and putting. The other would divide their attention between shift or repair work, and working as drivers, rolleywaymen, etc. I therefore give a last summary, showing what I think would be the best proportioning: Hewers, 419. Compound class I, partly hewing and partly putting, 63; officials and deputies, 18; stonemen and shifters, 153; putters, 63. Compound class II, partly shifters and partly drivers, etc., 143; drivers, 58; rolleywaymen and lads, 85; making a total of 1000.

Compound class I could spend their hewing time either in the fore-shift or in the back-shift, as seems best to the manager. There will, of course, be the same loss of output under this scheme as under the preceding one.

I think my readers will understand the nature of the problem, and I trust they will also be able to follow the lines on which it will be solved, so far as the colliery manager is concerned. Further, I think much will be done in the way of improving secondary haulage. Instead of a great number of drivers with cobs, electrically-driven locomotives might well be introduced. Indeed, gathering locomotives, instead of pony putters, could in many cases be introduced with advantage.

An act such as the home secretary has drafted must sooner or later become law, and when it does I am sure the new circumstances will be met with the skill and ingenuity so characteristic of the mining engineer.

When not equipped with winding machinery, air shafts used as second openings should be fitted out with ladders as they interfere less with the ventilation than do stairways, however, as far as the convenience of the men is concerned the latter are preferable.

According to the *Iron Age* trials of briquets of bituminous coal have been made by the navy at Norfolk, Va., and show that they gave better results as steam raisers on the torpedo boats than raw coal.

The Systematic Development of a Coal Mine

An Irregular Bituminous Seam Where the Various Problems of Mining, Haulage and Ventilation Have Been Effectively Co-ordinated

BY WILLIAM LECKIE*

The new branch of the Norfolk & Western Railway in the Pocahontas coalfield, known as the Pocahontas & Western Railroad, which is now under construction from Pocahontas, Va. through the Laurel valley, connecting with the Dry Fork at Horse Pen, Va., and also with the Dry Fork by way of Perryville to Iager, W. Va., is opening up some of the richest coal lands in that section. Work has been under way from both approaches for more than two years, and on the Pocahontas end, is now above the town of Boissevain, a new operation of the Pocahontas Collieries Company, the pioneers in that field. Lately this company has consolidated with the Pocahontas Consolidated Company of West Virginia, under the name of the Pocahontas Consolidated Collieries Co., Inc., with Isaac T. Mann, president, and James Ellwood Jones, general manager. The projection and development of the Boissevain plant was conducted under my personal supervision.

The new plant at Boissevain is intended to market a vast tonnage, and will in later years supersede entirely the famous Pocahontas plant, the coal from the present West, Baby and East mines at Pocahontas being taken out through the Boissevain opening. With this future in view, the plant was projected on generous lines, and the result is one of the best arranged and most up-to-date operations in the southern field. Shipments were begun in October, 1906, and now average 600 tons daily.

*Mining engineer, Jed, West Virginia.

Shafts 200 Ft. Deep

To reach the coal level, it was necessary to sink hoisting and air shafts a distance of 200 ft., and drive a traveling-way 1900 ft. long. The hoisting shaft is 30 ft. long x 13 ft. 6 in. wide, and is divided into two hoisting compartments, each 9 ft. wide x 13 ft. 6 in. long, with a pipe, wire, air and traveling-way occupying the balance of the space. The air shaft is 12x12 ft. in the clear, and the traveling-way, 7 ft. in hight x 10 ft. wide at the bottom, and 8 ft. at the top. The traveling-way extends from the surface at a point, approximately 400 ft. west of the tipple, intersecting with the rock tunnel (which runs from the bottom of the shaft), and from that point on into the mine, becoming the main empty branch.

The general ground plan shows an admirable arrangement. The large tipple of 3000 tons capacity, with its steel head-frame, stands at the mouth of the hoisting shaft; to the left over the air shaft, is a Clifford Capell fan; immediately in the rear of this are the boiler and engine houses; to the rear of the steel head-frame of the tipple is the hoisting-engine house. This compact arrangement of buildings places the generating, operating and marketing power immediately at the disposal of the operatives, making a saving both in first cost and maintenance, and giving the best possible guarantee of results.

With the exception of the tipple, which is constructed of wood and steel, the buildings are all of concrete, with corrugated-steel roofing. To allow for increased output, requiring additional machinery, or the establishment of neighboring plants of the company (to which it is proposed to furnish power by high potential lines), the buildings have been made large and roomy. The company has now under projection a plant to be located at Frazier, Va., some distance up the Laurel valley, above Boissevain, on the Pocahontas & Western line.

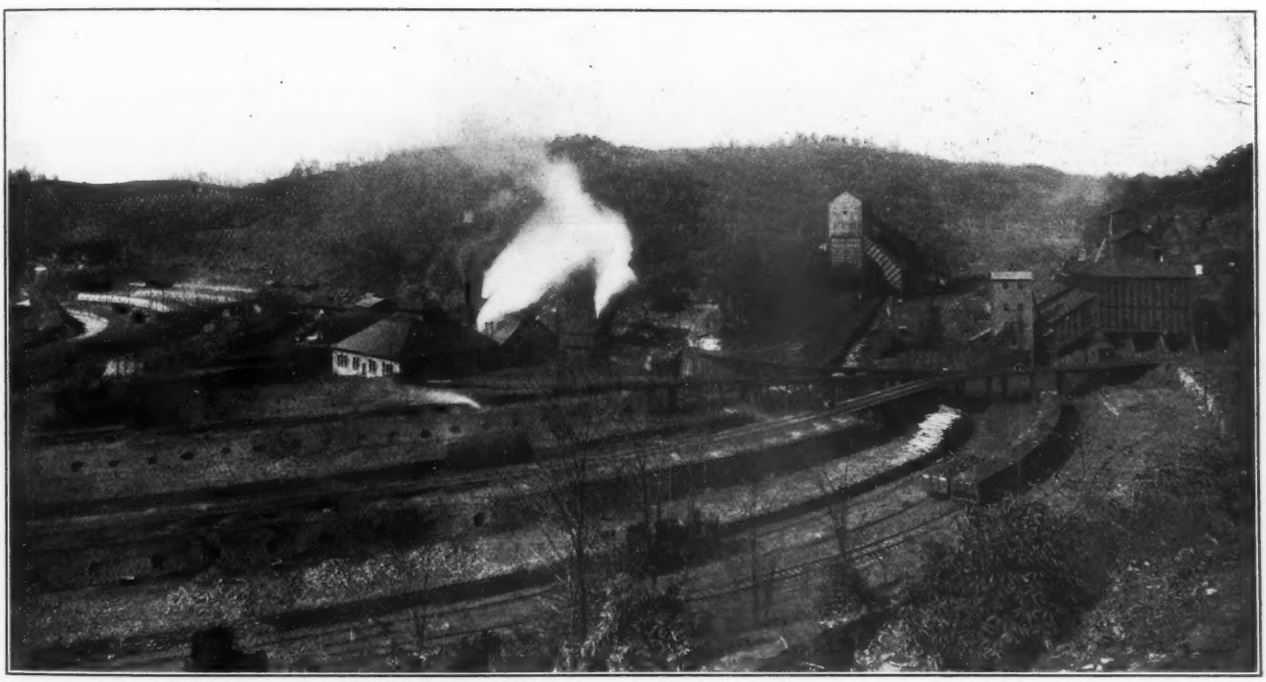


FIG. 1. GENERAL SURFACE ARRANGEMENT OF THE COAL PLANT AT POCAHONTAS, VIRGINIA

The Boiler and Engine Houses

The boiler, engine and generator houses, are side by side, and separated by a party wall; they occupy a ground

space of 10,000 sq. ft. The boiler house is at present equipped with two nests of the Aultman & Taylor type of horizontal water-tube boilers, purchased from the Stirling company, in four units, two of 264 h.p. and two of 414 h.p. each. Space has been left in this building for another battery of the latter horse-power. Induced draft for the boilers is furnished at present by two B. F. Sturtevant fans. In the engine and generator house, two direct-connected 24x27-in. Buckeye engines, operate a 200-kw. generator and a 400-kw. alternator. Steam is brought to the hoisting-engine house in covered steam lines. The engines are of the direct-acting Allis-Chalmers type, 26x42 in. in size, and are arranged with a Nicholson engine stop, manufactured by the Vulcan Iron Works.

FIG. 2. TIPPLE, HEAD-FRAME AND POWER HOUSE AT BOISSEVAIN MINE

Tipple Constructed by Day Labor

The wooden structure of the tipple was erected by day labor. The steel head-frame, cages, and tipple machinery were installed by the Jeffrey Manufacturing Company. The cages are of a late design of the "self-dumping" type, and are constructed on modern lines, embodying the most up-to-date principles. The chutes conveying the coal from the cars to the picking tables, are capable of being opened singly, kept closed or opened together, as desired, controlling the quantity of coal run upon the tables. From these tables, the coal may either go direct to the cars as mine-run, or be diverted onto the screens. The latter are of the stationary-gravity type, and yield the following proportions of Pocahontas coal: Lump, 30 per cent.; nut, 17 per cent.; small nut, 13 per cent.; slack, 40 per cent.

The large 18-ft. Clifford Capell exhaust fan, to the left of the tipple (the surrounding structure of which is also of concrete), is operated by a 22x22 in Porter-Allen engine, and is capable of supplying air to the mine for many years In addition to this ventilator, a small supplemental 6-ft. Robinson type of fan has been placed at the mouth of the hoisting shaft, to be used as a force fan in event of the Capell fan breaking down To operate this fan so as to furnish ventilation for the mine, it is only necessary to close a door leading out of the traveling-way.

The tipple tracks are arranged in the usual manner, for mine-run, lump and nut, with a run-around outside of the tipple proper. The empty storage tracks will accommodate 75 empties, while the tracks below the tipple will hold 100 loads. The company is now considering the question of erecting a block of 100 ovens, and it is expected that this work will be contracted in the early spring

FIG. 3. PART OF SURFACE ARRANGEMENT AT THE BOISSEVAIN PLANT

The Town of Boissevain

The town of Boissevain has been laid out on the same generous lines as the plant. Forty double and single houses have been erected for the miners and other employees, in addition to the numerous one-room shanties for the negroes. A baptist church has been erected on Valley street, and a schoolhouse will soon be completed. The company also contemplates the erection of a machine shop of concrete, for general car and locomotive repair-work.

The Underground Trip Feeder

At the bottom of the hoisting shaft, the very latest type of trip-feeding machinery, manufactured by Heyl & Patterson, of Pittsburg, has been installed. In passing from the loaded trip onto the cage, and as empties back to the point where they, are to be made into empty trips, the entire operation of placing the car on the cage and removing the empty is performed with the employment of but one man and a car oiler and coupler. The operator stands at the feeder, letting the cars down onto the car pusher. This pusher drives the car forward onto the cage, shoving ahead of it the empty car. This empty car runs a short distance beyond the cage, up onto a "kick-back," and then down grade to the point where the oiler and coupler stands to make up the empty trips. The loaded car is, of course, carried up onto the top of the tipple and dumped. The arrangement is excellent and has been operated successfully since October, 1907.

The Coal Seam Irregular

The coal seam at Boissevain presents almost all of the conditions to which coal seams are subject. The dip varies from 90 deg. (perpendicular) to level; the top, as at Pocahontas, is bad and the mine slightly gaseous. To counteract the irregular dip of the bed, three different systems of haulage are to be used. Where the dip is less than 5 per cent., the entries will be driven along the strike of the seam, and the rooms turned toward the rise. The haulage of these sections will be done by motor cable, whose heaviest load will be to push an empty car up a 5-per cent. grade. Where the dip is

over 5 per cent. and less than 20 per cent., the entries will run toward the rise, and the rooms be turned at a slight angle with the strike of the seam, so as to have a slight down-grade of about 1 per cent. from the face of the room to the entry. Haulage in these parts will be accomplished by third-rail motors. The motors will always be on the high side of the trip. This will allow the motors to pull the loads out of the rooms, and the partings will all be put in up-grade to prevent the car from running away down-grade, and causing accidents to men, motors and cars. Were the loads dropped in behind the motors, it is possible that they might knock the motor out of the rack, in which event the cars and motors would be wrecked at the bottom of the entry. This system will also test the motors, as they cannot pull any more than they can hold back on the guard rail. It will also allow the motorman to drop the cars into rooms. Fig. 4 shows the general method of turning the rooms and cross entries.

When the dip is above 20 per cent. (this section of the mine lies along the outcrop on the Laurel creek side), the entry will run along the strike of the seam, and the rooms be turned toward the rise. This system will be worked with two jugular manways. A battery of timbers will be placed at the mouth of each room to catch the mined coal as it falls from the face, and from here it will be passed through a sheet-iron chute, placed at the lower end of the cut, and be allowed to fall into the car. The haulage of this section will also be accomplished by third-rail motors.

Economy of Workings

The mine is laid out in rectangular shape, having haulways paralleling each other about every 1500 ft. each way. Each of these main haulways (accompanied by its air course) will be driven through a solid pillar of coal, at least 250 ft. thick, which will be left untouched as long as the haulage-way is used. The remaining spaces in between these main roads (each called a block) will be mined at once. Each block will consist of four panels, each panel to be an entry, with air courses on one side and rooms on the other. Each panel will have its entry and air course driven to their full extent before any rooms are turned. Then beginning at the face of the entry, the rooms will be turned successively, so as to make the line of the room advancing, having an angle of 45 deg. with the entry. As soon as a room is driven to its limit, the pillar between it and the next room will be robbed, the robbing beginning at the face of the room, and working toward the entry. This will make the line of ribs retreating have an angle of 45 deg. with the entry. In panel No. 1 of each block, the rooms will be driven a required distance, and stopped. In panels Nos. 2, 3 and 4, the rooms will be driven through the air course and into the entry of the next panel, and will then be robbed back from there. While each panel will have its own line of rooms advancing, the line of ribs retreating will be the same for all four panels in the same block. As the rooms only take out one-third of the coal, this will allow the robbing miner the protection of two-thirds of the entry seam as pillars, and will also permit the total extraction of the seam in each block. Mining will be continued in this manner until the limit of the entry is reached, when, beginning at the most distant point, rooms will be turned in the pillars surrounding the entry, and driven through them. The ribs will then be robbed back, and this system of robbing the main pillars carried steadily back to the place where the haulway is still being used. The coal will be raised through a shaft on the self-dumping cages, in the manner described above.

Advantages of Driving Entries to the Limit

The method of driving the entry and air course to their full length, before any rooms are turned, involves a primary expense for the narrow work in the first entries and air courses driven, but in no others. For example, according to the system of mining at Pocahontas, in the past, the expense of the narrow work in each entry is borne by the rooms turned from it. According to the system here described, the expense of the first entries will be borne by the company. The rooms turned from the first entries will bear the expense of the narrow work in the entries being driven at that time, also, the rooms from these entries will pay for the next set of entries, etc., etc., as far as the mine extends, when the rooms from the last set of entries turned, will have no narrow expenses to bear. Were the rooms turned as the entries advanced, one of two greater evils than entry expense, would be sure to follow:

First: If the pillars were robbed as soon as the rooms were driven, this would both cut off all air from the working face of the panel, and leave no pillars to protect the haulage road and return, rendering a fall of roof imminent at any time. In brief, this plan is impracticable. Second: If the pillars are left until all the rooms are driven and then robbing is carried back from the face of the entry, this involves the double expense of relaying the track and cleaning up whatever falls may have occurred in each room, which latter would be considerable, owing to the bad top of the mine. It may be mentioned in this connection that, at Pocahontas, coal mined from the rooms costs 80c. per mine car, while coal mined from the pillars between these rooms costs in all cases $1.00 to $1.10 per mine car, owing to the falls which it is necessary to clean up. The average thickness of the seam is 10 ft., which, roughly considered, will yield 13,000 tons of coal per acre. The mine will have an extent of at least 3000 acres, which places the total output of the mine at 39,000,000 tons, allowing a loss of 10 per cent. (which is a safe allowance for all losses of Pocahontas coal); this would reduce the total delivered in the railroad cars to 35,000,000 tons. Two-thirds of this, or 23,333,332 tons is pillar coal, on which it is proposed to make a saving of 5c. per ton or 15c. per car on the cost of mining. This would effect a total saving of $1,066,666.66.

Drainage

The local drainage of the mine will be accomplished by electric pumps. The seam dips from both Laurel creek and the Tug river side. At the point where the seam is lowest, and as yet undetermined, will be established the main pumping station, which will be equipped with steam pumps. Natural drainage will carry all the water in the mine (except from the west, where it will be pumped) to this point, from where it will be thrown out, through one or more boreholes. The seam dips slightly to the west, and when the mine has advanced far enough in that direction to justify, the main pumping station will be moved to the western edge of the mine, and natural drainage will carry all water to this point again, where it will be thrown to the surface as before, through bore holes; as soon as a hole is driven through to the Tug river side (north of Boissevain), the drainage will be to that side, saving the expense of lifting this water 185 ft. to the surface on the Boissevain side. The second west entries will be driven to the Baby mine, now being operated from Pocahontas, and when connection is made with the Baby mine entries, a dam with a door large enough to allow a car to go through, will be built, and a 14-in. pipe with gate valve will be placed, to hold or allow the Baby mine drainage to be passed or held at will, and make the Boissevain pumping station handle the water from the Baby mine below water level.

Safety from Gas

Every panel in the entire mine will receive its separate split of fresh air, and its air course will deliver it through a main return airway direct to the fan. Air, will, in no case after having been used by one panel, pass into a haulage road. Each panel will also have a regulator by which that block can be given just as much or as little air as it requires, without affecting the ventilation in any other

part of the mine. Each panel will, therefore, according to its needs, receive sufficient fresh air to carry away all gases. One man would attend to the regulating of the air in the mine, throughout its entire extent, and no one else, except in case of emergency will be allowed to adjust the regulators. Should an explosion occur, from any cause, in any part of the mine, the panel, block, or section in which it occurred, could be treated independently; if desired, the ventilation could be shut off entirely from it, if it were wished to clean the affected portion out, the products of combustion would pass directly out of the mine, through the fan, and in no case would the influence of the explosion extend beyond its immediate vicinity, or stop work in any other portion of the mine.

Ventilation

The mine will be ventilated by the fan referred to in the first portion of this article, of the Clifford Capell type 6x18 ft., which will be used as an exhaust; the Robinson type of fan 4x6 ft. set over one compartment of the hoisting shaft (as described), will be used in case of accident to the larger fan. The shaft and two manways will be intakes, delivering the air to the two main haulage roads of the mine. The air will have a first split into the cross-main haulage roads; from each of these it will have a second split into the haulways from each block, where it will be split a third time into the different panels, returning in precisely the same manner to the two main return airways, each 12 ft. wide. These airways which accompany the main haulage roads of the mine, collect all the impure air, and carry it beyond the shaft where one of the returns, overcasts above the manway, and the two return airways become one, having a width of 24 ft., which will be substantially timbered and will follow the seam to the outcrop, where the air is delivered to the fan. The fan will be provided with an arrangement by which the direction of the air can be reversed, should a contingency occur to require it.

This system of ventilation necessitates using overcasts in place of doors, but in the long run, it is more economical and much more satisfactory and safe. If the price for an overcast is estimated at $150, and it will take the place of a door, whose first cost is $15 and whose daily cost is $1 a day for a boy to attend to it, it can be seen that each overcast will pay for itself in less than a year.

An overcast is subject to no inconvenience or danger that a door does not equally share, but a door has many disadvantages that do not apply to an overcast. The door boy may not come to his work every day, he may be negligent in opening and closing the door at the proper times, the door may be propped open carelessly, and then accidentally close on a passing trip, which, if the cars are going in the right direction, would wreck the door. Again, should a door at any place be left open (as is often the case in the absence of the foreman) or wrecked, it cuts off the entire ventilation from all the workings inside of that place. Should it become necessary, in a moment of emergency to reverse the air current, it would cause all ventilation to come to a standstill, as the air would force open every door. None of these disadvantages hold true of an overcast. The greatest advantage, however, to be derived from an overcast is, that only by using them can each entry have its own supply of fresh air. If doors are used, the air cannot be split, but must be continuous. It must pass from one panel into another, and in case of fire or explosion, the affected part would discharge its gases into the working panels between it and the fan. The ventilation of each panel could not be regulated, and must have the same air as other sections. To stop the air in one panel, is to stop it in every inside panel as well. This overcast method is also more economical from the fact that splitting the current of air greatly reduces the required ventilating power of the fan.

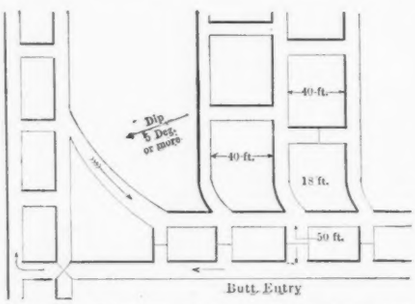


FIG. 4. PLAN OF WORKING AT BOISSEVAIN

Simplicity

This system of ventilation can be readily understood. Should a sudden emergency (for instance an explosion) arise, it would not be necessary for an exploration or rescue party to be acquainted with the exact place in the mine. By being acquainted with its system, they would know how to proceed, where to examine, and that done, would know just how to act to the best advantage, and what could or could not be done without danger. In some cases, breakthroughs exist in a mine, connecting separate parts of it, and these breakthroughs are not shown on a map, and in the instance above cited, may occasion the death of the rescue party. At the Pocahontas mine, several years ago, Superintendent O'Malley and his rescue party lost their lives by being caught in the afterdamp, which passed through breakthroughs from the Baby to the West mine. According to the system here described, no such crosscuts could exist, only where they would be expected.

Colliery Notes

At the No. 5 breaker of the Lehigh and Wilkes-Barre Coal Company, at South Wilkes-Barre, all records in hoisting were recently broken. There were 1115 cars put through the breaker in 9 hours.

During 1907, 7,350,000 tons of soft coal were burned in New York City, in spite of the regulations of the health department which prohibited its use. In addition to this, 10,400,000 tons of anthracite were consumed.

Of the 126 grievances presented since the Anthracite Conciliation Board's formation, 13 were sustained by the board, and 86 were not sustained, or were withdrawn. Of the 27 upon which the board could not agree, the umpire sustained 6, while 21 were disapproved.

In Germany, milk of lime has been successfully used to fight gob fires in coal mines. The place on fire is shut off by a brick wall; as soon as the fire reaches the wall, a hole is bored in the hottest part of the partition, a tube is inserted and milk of lime, five parts water and one part lime, is forced into the fire. The high pressure used forces the lime into the cracks and crevices of the coal.

In mining pitching seams of anthracite coal an effort has generally been made to hold the water in each lift by leaving comparatively large chain pillars on the lower side of the gangway; on a heavy pitch and with thick seams these pillars were necessarily large and were the source of a considerable loss of coal. This method has now practically been abandoned and the water is allowed to seek its way into the lower workings from which it is pumped out. The concentration of water by this plan does away with the extra work of keeping open the gangways on the worked-out lifts, and the chain pillars may be mined as soon as the upper gangway road is no longer employed for transportation or ventilation.

The collieries of the Dortmund district in Germany have a system of impregnating mine timber that has proved quite successful. The chemicals used are coal-tar oils or solutions formed principally of these oils. Also creosote oil or a mixture of coal-tar distillates with a high boiling point are used. The three methods employed are: painting the timber, dipping it into the preserving solutions and saturating it when under pressure. This latter method consists of placing the timber in a cylindrical iron vessel, steaming it for 45 min. and then subjecting it to a vacuum, then admitting hot anthracene oil and subjecting it to pressure for 40 min. The amount of pressure varies with the different kinds of wood being prepared. This treatment gives especially good results in the case of timbering which is in contact with outgoing air currents, such as that used for air courses and shaft timbering.

THE ENGINEERING AND MINING JOURNAL

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROBERT MCKEAN, Sec'y.

505 Pearl Street, New York.

London Office: 6 Bouverie Street, London E. C., Eng.

CABLE ADDRESS "ENGMINJOUR, N. Y."

Subscription, payable in advance, $5.00 a year of 52 numbers, including postage in the United States, Mexico Cuba, Porto Rico, Hawaii or the Philippines. $6.50 in Canada.

To Foreign Countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York office in every instance.

Advertising copy should reach New York office by Thursday, a week before date of issue.

For sale by all newsdealers generally.

Entered at New York Post Office as mail matter of the second class.

CIRCULATION STATEMENT

During 1907 *we printed and circulated* 507,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

Our circulation for March, 1908, *was* 40,500 *copies.*

April 4	13,000
April 11	9,500
April 18	9,500
April 25	9,500

None sent free regularly, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials:

The Cananea Blast Furnace..... 867
The Proposed Bureau of Mines..... 867
Mining Prospects in California..... 868
A Reflex Movement..... 868
Standard Oil in California..... 868
*The Cananea Blast Furnace. *Charles F. Shelby* 841
Custom Tunnels for Drainage and Transportation of Ore..... 852
The Smoke Nuisance at Indianapolis.... 852
*Rawhide, Nevada....*Algernon Del Mar* 853
British Pig Iron Production..... 855
Portland Cement Production in 1907.... 855
*Cost of Lake Superior and Montana Copper.....*James Ralph Finlay* 856
The Ozark Zinc Oxide Works, Coffeyville, Kan..... 860
*The Eight-hour Bill as Related to English Coal Mining. *George Raylton Dixon* 861
*The Systematic Development of a Coal Mine.....*William Leckie* 863
Colliery Notes..... 866
Correspondence:
John Mitchell and the Bureau of Mines.....*R. W. Raymond* 869
Geology of the Honerine Mine, Stockton, Utah.....*G. B. Wilson* 870
The Corrosion of Iron. *Allerton S. Cushman* 870
Explosive Effect of Electric Currents on Coal Dust..*Timothy W. Sprague* 870
A Suspended-frame Frue Vanner. *August Taylor* 870
Matte Smelting at Ingot, Cal. *Herbert Haas* 870
The Mining and Metallurgical Society of America..... 871
The Proposed Bureau of Mines..... 871
Iron Ore Production in 1907..... 871
Patents..... 872
Personal, Obituary, Societies and Technical Schools..... 873
Industrial, Trade Catalogs, Construction News..... 874
Special Correspondence..... 875
Mining News..... 877
Markets, etc..... 882

*Illustrated.

The Cananea Blast Furnace

In the JOURNAL of this week we give an unusual amount of space to a single article, but Mr. Shelby's contribution is of a character that deserves it, and our readers will prefer to have it in a single issue, rather than divided among two or three issues. This is one of the rare articles that covers its subject thoroughly, and gives all of the essential details, both in text and in drawings—the universal language. The new Cananea blast furnace is the result of practical developments in a large smeltery, which in the past has had an unusual variety of furnaces. All of the old furnaces were defective, but most of them had some good features which have been adopted in the new furnace. Comparisons generally have to be made between furnaces in different works, where the conditions may not be precisely parallel. Consequently the opportunity to try different furnaces in the same works, under absolutely parallel conditions, is one that is greatly to be prized, and is likely to lead to extraordinarily valuable results.

There may be some who will consider that such an exposition of details as Mr. Shelby makes is a gift to the public that detracts from professional prestige, inasmuch as it enables the less experienced to take advantage of the education and study of engineers which is their stock in trade. But such a view is a mistaken one, as has been repeatedly pointed out by Dr. Douglas, who is the greatest exponent of the campaign of education against secrecy in the arts. Let anyone read Dr. Douglas' last paper on this subject, presented at the Toronto meeting of the American Institute of Mining Engineers, July, 1907, and then see if he can refrain from applauding such liberality as Mr. Shelby has shown.

To paraphrase some of Dr. Douglas' remarks: We cannot succeed singly, for few of us claim to be so encyclopedic in our knowledge or universal in our experience as to make it safe to rely on our own acquaintance with the practical details of every one of the important departments. We, therefore, seek each other's assistance, and consequently share in each other's secrets; for every man's special knowledge is to the other man, who is more ignorant or inexperienced, a secret, or a "mystery" as old tradesmen and professional men used to call it. Every industrial advance brings us closer together and makes it more impossible to act independently. Coöperation has been made possible by the publication and exchange of ideas and experiences in the technical journals. Would not our progress be even more rapid and thorough if all barriers of secrecy were broken down, and every encouragement were given to our technical workers to describe, in print and by conference, their notions and their actual experiments? When men are working in the open the air is freer and purer than in the stifling atmosphere of secrecy. A consolidation of mind and high impulses would carry us farther and faster along the road of human progress than all the money that all the trusts could appropriate for the advancement of technical knowledge. This is why such a contribution as Mr. Shelby has made is particularly noteworthy.

The Proposed Bureau of Mines

The report of the hearings before the committee of mines and mining of the House of Representatives to consider the question of the establishment of a bureau of mines, a volume of 136 printed pages, betrays an astonishing absence of information. For the fame and good name of our country, we hope that it will not fall into the hands of any foreigner, because it would assuredly convey the impression that we have no engineering profession in this country and indeed do not know much about mining, so we are hysterically beseeching Congress to create a Bureau of Mines to teach us a few things. One gentleman demands that something be done to reduce the loss of life in collieries by 50 per cent., and another says wisely that if that can be done it will be easy to eliminate the remaining 50 per cent., so there will be no fatal accidents at all. (Even the foreigners, whose mining bureaus are enviously regarded, have not been able to accomplish that). Another gentleman wants the Government to show how ores can be worked at a profit that at present are valueless.

However, the metal miners were not much in evidence at the hearings, the coal miners chiefly occupying the stage, drawing long faces over the recent disasters. This was simply throwing dust in the eyes of the ignorant. The causes and conditions of explosions and the other accidents in mining have been in-

vestigated and investigated, and although the last word has not been said on the questions (and never will be) nevertheless a vast amount of useful, scientific knowledge has been accumulated in the reports of commissions, transactions of technical societies, the files of engineering journals and elsewhere. The seeking for further knowledge is not an immediate remedy for existing evils. The real remedy is to enforce the laws of the States, revising them, if necessary, to bring them into line with the latest knowledge, but anyway enforce them!

If the operators and representatives of the miners' unions, who have been imploring Congress to come to their aid, lest they be killed, would join hands in their several States, and create a respect for the laws of their States they would do something useful. They themselves are to blame for the feeling that the States are impotent and the Federal Government must be invoked as the only power that can do anything in this country. Occasionally in the hearings it was recognized that the States only could act; that the Federal Government could only supply information. By all means let us have the Governmental information even if with a bushel of chaff we get only one grain of wheat and its cost is that of a diamond. But let it not be forgotten that there is a great engineering profession which already has information to give, that the States have the power to act, and that, if the Federal Government wants to suggest or advise the States in this particular matter, a first-class engineering commission would be vastly better than a bureau of mines.

Mining Prospects in California

The whole State of California is suffering for lack of rain, none having fallen since the middle of March, although this is the rainy season. Very little is to be expected after the end of April, until November brings the first rain of the next season. The snowfall in the mountains was generally light last winter, so that the flow of water in the streams will be light this spring, which is very bad for the mining industry. Many complaints are already being heard from the gravel miners in the central and upper portions of the State, and none of them now expect any very extended water supply. With a light snowfall in the mountains it is not to be expected that the streams lower down in the foothill regions will carry much water for very long. For this reason a rather short washing season is expected by the gravel miners. Moreover it is probable that quartz mining will also be affected, as the supply of water for power will give out a month or two earlier in the fall than is usual when there is plenty of snow in the mountains to feed the streams, reservoirs and ditches through the summer months. In most large quartz properties they now have an auxiliary steam plant to tide over just such emergencies, but smaller companies cannot go to this expense. Therefore, when the water supply for power for direct use, or for generating electricity, gives out, the mills must close down. The outlook is not at all cheerful for the miners in this respect.

A Reflex Movement

At the present time there is apparent a tendency on the part of miners who went to Nevada on the outbreak of the excitement at Tonopah, and later, to return to California in search of mines. The cost of shipping, working, etc., of the Nevada ores at present is such that, though the veins may be comparatively rich, there is little profit in working the mines as compared with what may be done in California with free-milling ores of the same average value, or even less. Moreover there is plenty of wood and water generally in all the camps in the upper portions of California, and the cost of transportation, living, etc., is much less than in Nevada. Water-power is abundant and so is electric power, while the comforts of life are more easily obtainable than in Nevada. Of course, some of the big Nevada mines have made millionaires of prospectors or miners, but the big mines are about as scarce there as they are in other mining sections. At any rate, numbers of Nevada men—many of them former Californians—are now making investments in California mining districts.

Standard Oil in California

The Standard Oil Company in California has formed a "producing corporation" and is acquiring large tracts of land in certain sections of that State on which wells are being sunk for oil. Thus far these operations have been confined to sections near Hamford in King county, and King City in Monterey county. In the latter region the company has purchased or bonded the oil rights to upward of 50,000 acres of land. Most of this is agricultural or grazing land on the edge of the foothills, on the east side of the Salinas valley. The region extends from King City to San Ardo, on the Southern Pacific railroad. Some little prospecting for oil has heretofore been done by individuals in this region but with indifferent success. Indeed there have been no productive wells developed. The Standard experts, however, consider this a desirable and promising oil territory and it is now being developed at several points. The oil thus far found is of a very high grade. This is a new departure for the Standard on the Pacific coast. Heretofore it has bought oil and taken contracts, but has not bought lands, nor entered the producing field.

NOW THAT JUDGE GARY and Charles M. Schwab have both once more assured the public that the price of steel will be maintained, although "of course it will be reduced if necessary," everyone is ready to believe that a reduction by the big producers is imminent. As a matter of fact the independent producers have been secretly cutting the price, and indeed are quite openly agreeing to pay the freight, which is equivalent to a concession in price. It is a question merely as to how long the big producers will be content to let the smaller ones have the market.

A BILL IS NOW pending before the Maryland Senate providing for a tax of 0.4c. per ton on all coal mined in Maryland. The money to be collected by this tax is to go to the widows of men who are killed in the mines of the State. It is probable that the bill will pass the Senate. This may be class legislation, but at all events its purpose is so distinctly humanitarian that it would be hard to find fault with it.

WE UNDERSTAND THAT Robert N. Bell, the State Mine Inspector of Idaho, intends to retire from that position at the end of his present term. We hope that the citizens of Idaho will not allow him to do so, inasmuch as he has been a highly efficient official, whose services the mining industry of the State cannot well afford to lose.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

John Mitchell and the Bureau of Mines

It is reported that the principal immediate duty of the proposed Federal Bureau of Mines is to be the investigation of the causes of the increased loss of life, in recent years, through accidents and disasters in mines.

At the late New York meeting of the American Institute of Mining Engineers, this subject was discussed in interesting papers and addresses by Prof. J. A. Holmes, Chief of the Technologic Branch of the U. S. Geological Survey, and his assistant, Dr. W. O. Snelling.

But these gentlemen did not emphasize the chief cause of the evil which they pointed out—namely, the lack of discipline in mines, by reason of the loss of control over miners, on the part of operators and superintendents.

Discipline requires the strict enforcement of the rules required for safety and efficiency of operation. But neither in the mines nor on the railroads of this country can a workman now be discharged for the simple infraction of a rule, if no harm actually followed. A recent writer has accused railroad officials of complicity in this lax administration, under which rules are obeyed in the discretion of the employees. No doubt that is true; but the cause lies deeper, in the domination of the labor unions. I could give many instances, known to me, in which the attempt to enforce discipline has caused instant strikes, involving (even when the "Committee" of the Union subsequently ordered the men back to work) the loss of many days' operation, for which the owners received no compensation.

Three railroad presidents and three mine-managers have recently confirmed my impression—indeed, I think the fact is notorious—that since the labor unions, encouraged by the attitude of President Roosevelt, assumed control of affairs, there has been a steady increase in the loss of life and the destruction of property, coupled with a decrease in the efficiency of labor.

Outside of this factor, there is little to be investigated, as to mine disasters at least. The causes and conditions of explosions and the necessary precautions with regard to them have been investigated at home and abroad by competent engineers and government commissioners; and while further inquiries and experiments might be scientifically useful, even if their results were only confirmatory, no practical remedy for the present situation can be produced or proposed until the very heart of it is laid bare—namely, the lack of discipline, due to the denial of the authority which should accompany the responsibility.

It is questionable whether any Federal Bureau would have the moral courage to lay bare this cause and place the blame of it where it belongs. But there can be no doubt of one thing—the appointment of Mr. Mitchell as the director of such a bureau would be fatal to its efficiency. Every mine-manager knows that; and I shall not stop to prove it now. On some future occasion, I may specify some particulars, showing that Mr. Mitchell has openly (and, no doubt, conscientiously) opposed rules intended for the safety of mines and miners. At all events, it is clear that his fitness to direct a Bureau of Mines does not consist in scientific knowledge, which he does not claim, and that his appointment to that position can have but one reason—the desire to propitiate the labor unions. Rightly or wrongly, they are charged with having destroyed the discipline, and increased the danger, of their own occupation. To put their chief representative at the head of an investigation involving this charge is not the way to secure truth or justice.

Personally, I am not an advocate of the establishment of a Federal Bureau of Mines. But, knowing that many of my friends and professional colleagues earnestly favor it, I have not felt called upon, hitherto, to oppose it actively. It is now "up to them" to see that their cherished design is not made abortive at the outset. Some of us have always thought there was danger that politics would get into such a scheme sooner or later; but we did not dream it would be born political!

There ought to be from the proposers and friends of this bureau, such an overwhelming expression of opinion as will prevent the appointment of John Mitchell, or any other man of his class, to be its chief.

It is not at all clear that the President has really determined to offer this place to Mr. Mitchell, if the Bureau of Mines bill should pass. Mr. Roosevelt's way of feeling the public pulse by unofficial rumors, before coming to a final decision, is pretty well known. Very probably, a little timely indignation, just now, would bring out a semi-official statement that there never had been any danger of this appointment. But that will not prove the indignation to have been unnecessary.

R. W. RAYMOND.

New York, April 16, 1908.

Geology of the Honerine Mine, Stockton, Utah

In the JOURNAL of March 21, there appears an article entitled "Mining and Milling at Stockton, Utah," in which the Honerine mine and equipment are described. The article is evidently based upon a hasty visit to the property; for the author has confused his strikes and dips, and has not arrived at a distinct understanding of the geological situation which is capable of complete and satisfactory solution.

The geology of the Honerine mine is important in that it exemplifies in a most striking manner a number of characteristics which are common to several other limestone replacement deposits of Utah, and a careful study of which might add materially to our knowledge of this class of deposits. The mass of the mountain consists of stratified limestone of a light gray color striking nearly east and west and dipping 65 deg. north. Four thin strata of black limestone occur conformably in the gray limestone and these strata are known locally as "veins" for they contain the orebodies. The most northerly of these strata is called the Hercules "vein." Approximately 200 ft. south of the Hercules is the next stratum known as the St. Patrick "vein." About 250 ft. south of this "vein" is the third stratum, the Ada "vein," and nearly 350 ft. farther south is the fourth black limestone stratum, the Honerine "vein," which has been more extensively exploited than the others.

A series of fissures striking north and south and dipping approximately 70 deg. west crosses the sedimentaries. These fissures are open channels containing little filling excepting fragmentary matter. Oxidation has extended in the fissures as deep as the lowest mine workings, but the sulphide zone is encountered in the orebodies about 560 ft. above this point. Some faulting has occurred along the fissure planes, the western walls generally being thrust northward, but in a few instances the faulting has been in the opposite direction. There are occasional igneous dikes more or less paralleling the fissures.

The mineral-bearing solutions have traveled along the fissures and replaced the black limestone to form orebodies. However, only in two instances has ore deposition taken place in the fissures and these are merely extensions of orebodies which occur normally at the intersection

of a fissure and a black limestone stratum. Although a small amount of ore deposition has occurred in the black limestone under the fissures, by far the major portion of each ore shoot lies on the hanging-wall side of the fissure. Also the replacement has extended more rapidly along the hanging walls of the black limestone strata, so that the western limit of each shoot contracts to a hanging-wall streak which usually dies out in a short distance, leaving the black stratum unchanged until the next fissure is reached.

This would seem to indicate strongly that the mineralization has been due to ascending solutions. The solutions traveling along the fissures have not in every case mineralized the black limestone at the points of intersection with the fissures. Many times the black stratum is faulted but not otherwise affected. Also a fissure which has developed an orebody on one "vein" has not always developed ore at its intersections with the other black strata, but generally speaking, the occurrence of the orebodies is remarkably uniform.

It would seem that careful research should reveal a scientific reason why the black limestone should have been attacked by the mineral-bearing solutions while the gray limestone was unaffected. Not only this, but the chemical nature of the solutions should be arrived at with a considerable degree of accuracy, since the reaction resulting in the ore deposition has almost certainly been due to the presence of a constituent in the one rock not contained in the other. Again, as stated above, where these conditions seem to have been duplicated elsewhere important orebodies have been formed. As an instance, in the Maxfield mine in Big Cottonwood Cañon, near Salt Lake City, the orebodies have been formed as replacements where fissures have intersected a very prominent black limestone stratum which occurs in gray and white limestone beds.

G. B. WILSON.

Salt Lake City, Utah, March 27, 1908.

The Corrosion of Iron

In a recent publication under date of May 10, 1907 (*Bulletin* No. 30, office of Public Roads, U. S. Department of Agriculture), entitled "The Corrosion of Iron," I discussed the possibility of using certain inhibitors in the priming coats of paints and other protective coverings. The suggestion was publicly made that slightly soluble chromates should be theoretically the best protectives to apply to iron and steel surfaces. I have tested numerous chrome pigments in reference to their inhibition value, the work having been done in large part previous to the publication of the bulletin above cited. Owing to included impurities, many of the commercial chrome pigments have been found to stimulate rather than inhibit corrosion, and the use of these for such purposes should be carefully guarded against. It has been found, however, that zinc chromate and a pigment made by precipitating barium and calcium chromates in molecular proportions give excellent results in the absence of impurities, such as sulphates, chlorides, etc. Prussion blue has also proved itself among the best of the rust inhibitors, so that excellent formulas can be devised for good greens, using the above pigments with small amounts of pure calcic carbonate, and magnesium silicates, etc. Some of the basic orange chromates have also given good results.

It has been reported that patents have recently been applied for on a combination of zinc chromate with linseed oil as an inhibitive coating for iron and steel. The details of the claims cannot yet be known, but in view of the general publication of my results, it does not seem that the grant of such a patent would be justified. It is the policy of this department to give out the information it obtains for the free use of everyone in the country, and particularly to safeguard the interests of the farmers. It would be a misfortune, in case these inhibitive formulas prove themselves of high protective value, that their general use should be tied up by individual patent claims.

ALLERTON S. CUSHMAN,
Office of Public Roads,
U. S. Department of Agriculture.
Washington, D. C., April 9, 1908.

Explosive Effect of Electric Currents on Coal Dust

I have been interested in reading an article on page 722 of the April 4 issue of the ENGINEERING AND MINING JOURNAL, on "Explosive Effect of Electric Currents on Coal Dust." The subject is one which is of particular interest at the present time, owing to the recent dust explosions in this country, and the question of their prevention. The article describes the method of test, and gives a table showing the temperature, expressed in degrees C., caused in a small coil of platinum wire by the passage of different amounts of current.

In the summary of results, the amount of current, instead of temperature, is treated as the important item. This is misleading to the reader, as the interesting and important fact is the temperature causing these explosions, and the amount of current flowing is merely one factor in the temperature reached; the other factor being the resistance of the wire, which resistance depends on its size and material. To anyone unfamiliar with electrical phenomena and using current, a glance at the summary might give the impression that the currents spoken of are dangerous in any dusty mine; while the fact is that the temperatures given in the first part of the article of from 630 deg. C. upward, are the dangerous features, and would only be caused by these currents flowing through small wires, such as were used in the experiment.

TIMOTHY W. SPRAGUE.

88 Broad street, Boston, Mass., April 4, 1908.

A Suspended-frame Frue Vanner

Permit me to claim sufficient space in the JOURNAL to call attention to the statements made in the issue of Feb. 22, in an article descriptive of "A Suspended-Frame Frue Vanner." In that article, the statement is made that the side rods are "so arranged that the side shake imparts a peculiar motion to the belt, the longitudinal center line remains stationary in its vertical plane, but the sides of the belt are alternately raised and lowered. This imparts a motion similar to panning."

In this statement is an accurate description of the motion of the Risdon Johnston concentrator or vanner, which motion is produced through the agency of *non-parallel hangers*. This feature of the non-parallel hangers, is the subject of United States and other patents, under which the Risdon Johnston concentrator is manufactured solely by the Risdon Iron Works.

AUGUSTUS TAYLOR.

San Francisco, Cal., March 31, 1908.

Matte Smelting at Ingot, Cal.

Two serious errors have crept into my letter on smelting operations at Ingot, in the JOURNAL of March 28. In the first column , "about 5 per cent." should read "above 5 per cent.;" in the second column near the top, it should read "with coke costing $21 to $23 a ton, with only 2½ per cent. copper, 0.03 oz. gold, and 6 oz. silver." Also lower down, "$2.03 gold" should read "0.03 oz. gold." This is rather a serious error; the difference in gold between the actual 60c. carried in the burden and the $2.03 stated in the article is $1.43. The letter covered operations for three months, and contained the only figures I saved out of the San Francisco fire.

HERBERT HAAS.

San Francisco, April 3, 1908.

The only lead-producing district of great industrial importance ever developed in Nevada was Eureka. Lead ores have been mined and smelted at Oreana, Pioche, White Pine, and elsewhere, but the deposits at those places never proved of material consequence.

The lead-ore production of Prussia in 1906 was 127,322 tons, 10,755 miners being employed.

The Mining and Metallurgical Society of America

This society, to which we have previously referred as the proposed new mining society, was organized at the Engineers' Club, New York, April 20. The society comprises about 115 members, of whom about 20 were present at the organization meeting in person and about 60 by proxy. Prof. H. S. Monroe acted as chairman of the meeting, and J. R. Finlay as secretary. The business of the afternoon meeting consisted of discussion of the constitution and by-laws, prepared by the organization committee, the members of which were Professor Monroe, George W. Maynard, J. R. Finlay, F. Lynwood Garrison and J. Morgan Clements. The constitution and by-laws were adopted with a few amendments.

The new society is to be composed of mining and metallurgical engineers and mining geologists resident in North America. Its affairs are to be managed by a council of 15 members, who are to elect from their own number a president, not less than two vice-presidents, a secretary and a treasurer. Candidates for membership in the society must have had eight years' practical or professional experience, including not less than five years in positions of responsibility, in mining and allied lines of work. Graduates of approved engineering schools are to be credited with one-half the time prescribed for graduation. Candidates must be endorsed by three or more members, who will certify as to qualifications in writing. Candidates must be approved by the council, after which they are to be elected by vote of all the members of the society, adverse votes to the amount of 5 per cent. of the total cast serving to defeat the candidate.

The annual dues are to be $10. After the membership has reached 250 there is to be an initiation fee of $25 for further new members.

The territory occupied by the membership is to be divided into 15 geographical districts, each to be, as nearly as practicable, contiguous territory, and to contain as nearly as practicable an equal number of members. Each of these 15 districts is to elect a member of the council. Local sections of the society are to be organized for social, scientific and professional purposes in harmony with the constitution and by-laws, and it is contemplated that these local sections will hold frequent meetings.

After the afternoon session, the members dined at the Engineers' Club. After dinner there was a further session, during which there was a general discussion respecting the plans for the new society. These expressions of views indicated four lines of activity: (1) Frequent meetings of the local sections, to promote acquaintance, good-fellowship, and the discussion of technical and professional matters; (2) the determination of standards in engineering practice, such as is being done by the Institution of Mining and Metallurgy; (3) the discussion of questions relating to professional practice and ethics, with a view to the eventual formulation of a code of ethics; and (4) the discussion of questions of public policy in which the profession of mining engineering is directly concerned.

The details for carrying out these plans have not yet been determined, but will be immediately taken up by the council, which was elected at the meeting Monday afternoon. The organization meeting was highly successful and the members present were enthusiastic as to the probable usefulness of the new society. A highly friendly feeling toward the American Institute of Mining Engineers was manifested, and there is evidently no intention on the part of the new society to enter into rivalry with the Institute or to subtract membership from the latter. This was a consideration of much weight in the fixing of the dues of the new society at the low figure of $10 per annum. Practically all of the members of the new society are members of the Institute, who are of the opinion that the new society will occupy a distinct field.

The members of the council, elected April 20, are as follows: H. S. Munroe, W. R. Ingalls, and J. R. Finlay, of New York; Robert H. Richards, of Boston; F. Lynwood Garrison and W. A. Lathrop, of Philadelphia; C. B. Dudley, of Altoona, Penn.; Waldemar Lindgren, of Washington; L. S. Austin, of Houghton, Mich.; G. S. Rice, of Chicago; Joseph Hyde Pratt, of Chapel Hill, N. C.; C. R. Claghorn, of Tacoma; H. B. Patton, of Golden, Colo.; S. B. Christy and T. A. Rickard, of San Francisco, Cal.

The Proposed Bureau of Mines

The Committee on Mines and Mining of the House of Representatives has reported a bill in lieu of all the others previously introduced. This bill has been placed upon the calendar of the committee of the whole House on the State of the Union. An effort is being made to secure early action. Senator Knox, of Pennsylvania, has already secured an amendment to the legislative appropriation bill, which will enable the Federal Government to investigate the cause of mine disasters and conduct experiments for the prevention of such accidents. The appropriation scheduled for this purpose is $195,000. At present this is in the hands of a conference committee.

Sections 1 and 2 of the proposed bill for the creation of a bureau of mines are as follows, the third section being merely of administrative effect:

Section 1. That there is hereby established in the Department of the Interior a bureau, to be called the Bureau of Mines, and a commissioner of such bureau, who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall receive a salary of $6000 per annum; and there shall also be in the said bureau such clerks, agents, experts, and other employees as may be necessary to carry out the provisions of this act.

Section 2. That it shall be the province and duty of said bureau and its commissioner, under the direction of the secretary of said department, to foster promote, and develop the mining industries of the United States, to make diligent investigations of the methods of mining, the safety of miners, the possible improvement of conditions under which mining operations are carried on, the treatment of ores, the use of explosives and electricity, the prevention of accidents, the values of mineral products and markets for the same, and of other matters pertinent to said industries, and from time to time make such public report of the work, investigations, and information obtained as the secretary of said department may direct, with the recommendations of such bureau.

Iron Ore Production in 1907

As the United States Geological Survey has received statements from producers known to represent about half the output of the country, it estimates that the total production for 1907 will fall between 52,000,000 and 54,000,000 long tons. The total production in 1905 was 42,526,163 long tons; that of 1906 was 47,749,728 long tons. A total production of 53,000,000 tons in 1907 would amount to an increase of about 11 per cent. over the production in 1906. This gain was very unevenly distributed among the several producing districts. The Lake Superior district seems to show an increase of about 15 per cent.; the Southern district shows an increase of only 4 per cent.; and the Northern or Northeastern district gains 8 per cent. Statistics from the Western district are as yet very incomplete, but appear to show little or no gain over 1906.

Whatever corrections may be necessary in this estimate, final figures will show that the production of iron ore during 1907 was largely in excess of its consumption. The amount of ore held in stock at the close of the year at mines, ore docks, and other receiving points is probably the largest in the history of the iron trade.

While elsewhere silver is produced chiefly as a by-product in smelting copper and lead ores, in Mexico most of the silver is obtained from ores valuable mainly for silver.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

ALUMINUM-MAGNESIUM ALLOYS—Process of Producing Aluminum-Magnesium Alloys. Franz Von Kügelgen and George O. Seward, Holcombs Rock, Va., assignors to Virginia Laboratory Company, New York, N. Y., a Corporation of New York. (U. S. No. 881,934; March 17, 1908.)

ALUMINUM OXIDES—Method of Manufacturing and Treating Composite Aluminum Oxides. Max Buchner, Mannheim-Waldhof, Germany. (U. S. No. 883,286; March 31, 1908.)

COAL AND COKE

BRIQUET-MACHINE. Karl Wessel, St. Paul, Minn. (U. S. No. 833,263, March 31, 1908.)

COAL-AUGER. Matthew Martin, Gilmore, Md. (U. S. No. 882,475; March 17, 1908.)

COKE—Extracting Apparatus for Horizontal Retorts. Christian Eitle, Stuttgart, Germany. (U. S. No. 882,304; March 17, 1908.)

COKE—Process of Making Gas and Coke. Leon P. Lowe, San Francisco, Cal. (U. S. No. 883,466; March 31, 1908.)

COKE-DRAWER. David Ferguson, Pittsburg, Penn., assignor of one-fourth to Oliver G. Ferguson and one-fourth to Williams J. Ebken, Pittsburg, Penn. (U. S. No. 883,705; April 7, 1908.)

COKE-OVEN DOOR. John J. Alley, Bristol, Va. (U. S. No. 882,365; March 17, 1908.)

COPPER

ELECTROMETALLURGICAL PROCESS for Extracting Copper From Its Ores. Lucien Jumau, Paris, France. (U. S. No. 883,961; April 7, 1908.)

PRECIPITATION PROCESS for Obtaining Pure Copper From a Solution of Copper Lucien Jumau, Paris, France. (U. S. No. 883,962; April 7, 1908.)

GOLD AND SILVER

AMALGAMATOR. Henry I. Seemann, Denver, Colo. (U. S. No. 884,299; April 7, 1908.)

FILTER FOR CYANIDING—Continuous Filter for Cyaniding and the Like. Bertram Hunt, San Francisco, Cal. (U. S. No. 882,202; March 17, 1908.)

GOLD-WASHING SCREEN. William H. Roughsedge, Ottawa, Ontario. (U. S. No. 883,974; April 7, 1908.)

PLACER-MINING APPARATUS. John W. Hunsaker, Victor Beisswingert and Robert L. Davis, Anna, Ill. (U. S. No. 882,148; March 17, 1908.)

SEPARATION—Apparatus for Separating Gold. John A. Creasy, Norborne, Mo. (U. S. No. 833,861; April 7, 1908.)

IRON AND STEEL

ALLOYED STEEL—Art of Producing Alloyed Steels. James Churchward, New York, N. Y. (U. S. No. 884,009; April 7, 1908.)

BLAST-FURNACE SLAG — Method of Treating Blast-Furnace Slag. Frederick W. Wood, Baltimore, Md. (U. S. No. 883,770; April 7, 1908.)

CUPOLA. Newbold Ettings, Philadelphia, Penn. (U. S. No. 882,000; March 17, 1908.)

ELECTRODEPOSITION of Iron. Sherard O. Cowper-Coles, London, England. (U. S. No. 884,075; April 7, 1908.)

FERROCHROMIUM—Process of Producing Slag-Free Ferrochromium. John B. Huffard, Ferris, W. Va., assignor to Electro Metallurgical Company, Chicago, Ill., a Corporation of West Virginia. (U. S. No. 882,637; March 24, 1908.)

FERROSILICON—Process of Producing Ferrosilicon. Edgar F. Price, Niagara Falls, N. Y., assignor, by mesne assignments, to Central Trust Company of New York, a Corporation of New York, trustee under first mortgage. (U. S. No. 882,417; March 17, 1908.)

HARDENING—Art of Hardening and Toughening Steel. James Churchward, New York, N. Y. (U. S. No. 883,698; April 7, 1908.)

HARDENING STEEL—Method of Hardening Steel. William A. Painter, Allegheny, Penn. (U. S. No. 882,162; March 17, 1908.)

PUDDLING FURNACE. Martin Van Buren Smith, New York, N. Y. (U. S. No. 883,057; March 24, 1908.)

STEEL Containing Nickel, Chromium and Tungsten. Robert H. Illingworth, Newark, N. J., asignor to Crucible Steel Company of America, a Corporation of New Jersey. (U. S. No. 882,112; March 17, 1908.)

LEAD

ORE REDUCTION—Method of Reducing Lead Ores. Alfred Francis, St. Louis, Mo. (U. S. No. 882,193; March 17, 1908.)

NICKEL

PURIFYING PRECIPITATES—Process of Purifying Precipitates. Herbert H. Dow, Midland, Mich., and Walter S. Gates, Worthington, Ontario, Canada, assignors to Ontario Nickel Company, Limited, Worthington, Canada, a Corporation of Canada. (U. S. No. 883,792; April 7, 1908.)

SEPARATION OF NICKEL FROM MATTE—Process for Separating the Metals Contained in Copper-Nickel Matte. James M. Neil, Toronto, Ontario, Canada, assignor to Frederic C. Norris, trustee, Detroit, Mich. (U. S. No. 882,075; March 17, 1908.)

TIN

RECOVERY OF METALLIC TIN—Cyclic Process for Recovering Metallic Tin. Franz von Kügelgen, Holcombs Rock, Va., and George O. Seward, New York, N. Y. (U. S. No. 883,139; March 24, 1908.)

ZINC

ORE-TREATING PROCESS. Walter G. Swart, Denver, Colo. (U. S. No. 882,217; March 17, 1908.)

ZINC CHLORIDE—Process of Making Zinc Chloride. Robert R. Rust, Waukegan, Ill. (U. S. No. 883,426; March 31, 1908.)

METALLURGY—GENERAL

ALLOYS—Process of Producing Alloys or Compounds of Copper and Titanium. Auguste J. Rossi, New York, N. Y., assignor, by mesne assignments, to the Titanium Alloy Manufacturing Company, a Corporation of Maine. Reissue. (U. S. No. 12,764; March 17, 1908.)

ELECTRIC FURNACE. Albert L. Marsh, Lake Bluff, Ill., assignor to Hoskins Company, Chicago, Ill., a Corporation of Illinois. (U. S. No. 882,788; March 24, 1908.)

ELECTROLYSIS—Anode. Albert M. Hill, New Haven, Conn., assignor to C. Upham Ely, Brooklyn, N. Y. (U. S. No. 882,110; March 17, 1908.)

ELECTROLYSIS—Process for the Electrolysis of Fluid Salts or Compounds. Henry S. Blackmore, Mount Vernon, N. Y. (U. S. No. 884,124; April 7, 1908.)

REDUCTION PROCESS—Apparatus for Obtaining Metals and Alloys. Emilien Viel, Rennes, France. (U. S. No. 883,595; March 31, 1908.)

REDUCTION PROCESS—Process of Obtaining Metals and Alloys by Reduction. Emilien Viel, Rennes, France. (U. S. No. 883,594; March 31, 1908.)

SEPARATING INCOMBUSTIBLE MATERIALS HAVING DIFFERENT MELTING TEMPERATURES. Meredith Leitch, Brooklyn, N. Y., assignor, by mesne assignments, to Metal Process Company, a Corporation of New York. (U. S. No. 883,208; March 31, 1908.)

SMELTING SULPHIDE ORES. James T. Carrick and Stuart Pattison, Johannesburg, Transvaal. (U. S. No. 882,234; March 17, 1908.)

MINING MACHINERY AND APPARATUS

BUCKET—Clam-Shell Bucket. Arnold Ruetschi, Cleveland, Ohio. (U. S. No. 882,844; March 24, 1908.)

DREDGE—Bucket for Dredgers. George Francis, Chelsea, Mass. (U. S. No. 883,635; March 31, 1908.)

DRILL—Coal and Rock Drill. Henry R. Ford, Buffalo, N. Y. (U. S. No. 882,878; March 24, 1908.)

DRILLS—Pneumatic and Other Drills. Martin Hardsocg, Ottumwa, Iowa. (U. S. No. 884,331; April 7, 1908.)

GRAB-BUCKET. Clark Chase, Fall River, Mass. (U. S. No. 882,666; March 24, 1908.)

MINE CARS—Running-Gear for Mine-Cars. John M. Phillips and Robert F. Phillips, Carrick, Penn. (U. S. No. 882,533 and 882,534; March 17, 1908.)

MINER'S CANDLESTICK. Milton M. Gault, Medford, and Janie L. Stockbridge, Portland, Oreg. (U. S. No. 883,307; March 31, 1908.)

MINER'S KNIFE. George H. Landers, Boise, Idaho. (U. S. No. 883,648; March 31, 1908.)

MINER'S LAMP. Charles Murray, Trevorton, Penn., assignor of one-half to Charles O'Connor, Trevorton, Penn. (U. S. No. 884,191; April 7, 1908.)

ORE CARS—Door-Operating Mechanism for Ore-Cars. George C. Johnson, Los Angeles, Cal., assignor of one-half to Henry Lange, Los Angeles, Cal. (U. S. No. 884,091; April 7, 1908.)

ORE DRESSING

CRUSHING—Crusher Plate, Head, and the Like. Ferdinand M. Canda, New York, N. Y. (U. S. No. 883,619; March 31, 1908.)

GRINDING OR CRUSHING MILL. James J. Fraser, Leith, Scotland. (U. S. No. 883,872; April 7, 1908.)

MAGNETIC ORE-SEPARATOR. Richard R. Moffatt, New York, N. Y., assignor to Imperial Ore Separator Company, a Corporation of New York. (U. S. No. 882,158; March 17, 1908.)

ORE-CONCENTRATING TABLE. George E. Woodbury, San Francisco, Cal. (U. S. No. 882,511; March 17, 1908.)

ORE-CONCENTRATORS—Drive Mechanism for Ore-Concentrators. George E. Woodbury, San Francisco, Cal. (U. S. No. 882,512; March 17, 1908.)

ORE-SEPARATOR. Jared E. Belt, Minneapolis, Minn. (U. S. No. 883,278; March 31, 1908.)

SCREEN—Rotary Screen for Ore and Materials. Howard G. King, Denver, Colo. (U. S. No. 882,070; March 17, 1908.)

SEPARATOR. Hal J. Sisty, Carborca, Mexico, assignor of one-fourth to George F. Smith, Pittsburg, Penn. (U. S. No. 882,117; March 17, 1908.)

METALLURGICAL MACHINERY AND APPARATUS

ELECTRICAL SMELTING-FURNACE. Karl A. F. Hiorth, Christiania, Norway. (U. S. No. 883,311; March 31, 1908.)

ELECTRODE for the Recovery of Metals from Solutions by Electrolysis. Samuel B. Christy, Berkeley, Cal. (U. S. No. 883,170; March 31, 1908.)

FUME-CONDENSING APPARATUS. John R. Moffit, Denver, Colo. (U. S. No. 882,073; March 17, 1908.)

FURNACE—A Smelting, Crucible Heating and Annealing Furnace. Alfred Smallwood, London, England. (U. S. No. 883,916; April 7, 1908.)

METALLURGICAL FURNACES — Stock-Distributer and Gas-Seal for Metallurgical Furnaces. Merrill B. Parker, Rockwood, Tenn. (U. S. No. 883,044; March 24, 1908.)

ROASTING FURNACE—Mechanical Roasting-Furnace. Roman von Zelewski, Engis, Belgium. (U. S. No. 882,730; March 24, 1908.)

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. H. Granberry, of New York, has gone to Georgia on professional business.

Victor G. Hills, of Cripple Creek, Colo., is in Telluride, Colo., examining some mines.

Stephen R. Dow, of Boston, has been elected president of the Franklin Mining Company.

J. D. Wood, president of the Nevada Douglas Copper Company, has returned to Salt Lake City from a trip to southern California.

Silas W. Eccles, vice-president of the American Smelting and Refining Company, has been in Salt Lake and Ely, looking after company interests.

W. B. Bretherton, after eight years' experience as chemist and assayer with custom smelters, has opened an office at 532 Commercial street, San Francisco, for custom assay work.

Henry S. Washington and J. Volney Lewis, forming the firm of Washington & Lewis, mining geologists, will remove their offices on May 1 to the new Singer building, 145 Broadway, New York.

W. D. MacCausland, superintendent of the Federal Coal Company, at Hooversville, Somerset county, Penn., has resigned his position to accept that of general superintendent of the Haws Coal Company at Hollsopple, Somerset county.

S. E. Bretherton, late general manager of the Great Western Gold Company, at Ingot, Cal., has opened an office at 532 Commercial street, San Francisco, as consulting engineer. He has just returned to that city from Nevada, where he was examining some mining claims for California parties.

E. E. Keller, for over 20 years connected with the Westinghouse interests and for 14 years vice-president of the Westinghouse Machine Company, having completed his duties as receiver and general manager, severed his connection with the management of that company April 1. Mr. Keller will take a much needed rest and will then devote most of his time to several personal interests.

Obituary

H. Lawrence Price, of Toronto, a young engineer, died April 14, in consequence of injuries received 10 days previously by falling 100 ft. down the shaft of the Victoria mine in Algoma, Ontario.

Frithiof Lundahl, chief engineer of the Bethlehem Steel Company, died of heart failure in the Pennsylvania Hospital, at Philadelphia, April 11, aged 54 years. He was a native of Sweden, and was educated in Swedish schools. He had been in this country for more than 25 years. He had been employed by the Carnegie Steel Company before going to Bethlehem.

Truman M. Dodson died in Bethlehem, Penn., April 15, aged 78 years. He was one of the pioneers of the anthracite industry, having operated collieries in Pennsylvania for many years. He was one of the founders of the firm of Weston, Dodson & Co., and had been the head of the firm for a number of years. More recently the firm extended its activities to the bituminous field, and acquired mines in the western part of Pennsylvania and in West Virginia. Mr. Dodson was also concerned in a number of industrial enterprises in the Lehigh valley.

Societies and Technical Schools

Appalachian Engineering Association—The next meeting of this society will be held at Fairmont, W. Va., May 2. A large attendance is expected, and topics relating to coal mining will have a prominent part in the proceedings.

Michigan College of Mines—The Class Day address to the class of 1908 of this College at Houghton will be delivered May 1 at the college gymnasium, by Dr. Charles Richard Van Hise, president of the University of Wisconsin. The class dinner will take place the following evening.

Mining Institute of Nova Scotia—At the recent meeting in Halifax the following officers were elected: President, C J. Coll; vice-presidents, F. H. Sexton, J. H. Brown; secretary-treasurer, H. M. Wylde; council, R. H. Brown, A. Dick, G. W. Stuart, Jacob A. Johnson, B. F. Pearson, R. Drummond.

American Society of Mechanical Engineers—The semi-annual meeting will be held in Detroit, Mich., June 23-26. Papers will be presented at this session by W. D. Mount, Prof. George H. Shepard, H. Souther, Prof. L. S. Marks, Prof. W. D. Gregory, Prof. R. C. H. Heck, Henry Hess, W. H. Blauvelt and F. W. Dean. There will be a symposium upon machinery for conveying materials, with papers by several authorities. The Society for the Promotion of Engineering Education and the Society of Automobile Engineers will hold their annual meetings in Detroit at this time, which will enable members of each society to participate in the sessions of the other.

Institute of Metals—A meeting of copper and brass manufacturers, engineers and others held at Manchester, England, March 10, decided to form an organization under the name of Institute of Metals. It is the intention of those who are prominent in the movement to hold semi-annual meetings. Practical and scientific subjects relating to the manufacture, working up and use of the nonferrous metals will be discussed, and it is probable that twice a year a volume will be published of abstracts of papers and books on metallurgical subjects. An effort is now being made to interest Americans in the objects of the new institute. William H. Johnson, managing director of Richard Johnson, Clapham & Morris, Ltd., Manchester, England, has undertaken to act as secretary of the society during the indisposition of Professor Carpenter, who has been selected for this position. A special meeting is to be held in London at the Institute of Mechanical Engineers, Westminster, June 10 next.

Columbia School of Mines—In 1907, Columbia University, New York, revised the entrance examination requirements for its schools of mines, engineering and chemistry by simplifying them and coördinating them with the programs of the best secondary schools. By the adoption at the same time of a uniform program of studies for the first year in all courses, students were no longer compelled to make up their minds at the outset as to the particular course they desired to take, and it became much easier for college graduates to enter the schools with adequate credit for advanced standing. Following these steps has come the coördination and revision of the three subsequent years of each of the courses. This revision has just been formally adopted by the faculty at its March meeting and will go into effect on July 1, 1908. The programs have been thoroughly coördinated by cutting out such duplication of instruction as had grown up in the development of the several departments, and courses whose value has been lessened by changes in actual professional methods have been replaced by subjects of greater value to the professional students of today. Throughout, the inter-relations of lecture and recitation work with practical work in the laboratory have been carefully considered. The work in many subjects has been made more intensive and as a result it has been possible to reduce the total number of attendance hours in such courses. The free time created by this work of excision and condensation will make possible the introduction of important new material. For example, new courses in gas-power and steam-power machinery and in alternating-current laboratory practice have been introduced in the third year of the course in mining engineering. This work has also been introduced into the course in metallurgy, and, in addition, work in mining law and hydraulics.

The results of the change in entrance requirements and the uniform first year have been most satisfactory, the total new students in 1907-08 being 239 as against 162 in 1906-07, the number of entrance conditions carried by students also being reduced. It is expected that the new pro-

grams in the professional courses, together with the close personal contact which is now being maintained by the dean and the professors with all the students, will still further enhance the reputation of the historic Columbia School of Mines.

Coal Mining Institute of America—Advance notice is given of the publication of the proceedings of the Coal Mining Institute of America for the summer and winter sessions held at Pittsburg during 1907. These proceedings are to be well printed and attractively bound, giving a volume in keeping with its contents which are well worthy of preservation. The papers to be published are all by experts and cover a wide range of subjects relative to coal mining. The oral discussions, containing almost as much valuable matter, have also been fully and carefully reported. One of the chief features of the year's work has been the participation in the proceedings by the members of the U. S. Geological Survey shown by the following group of papers: Waste in the Mining and Preparation of Coal, Edward W. Parker; Government Research Work, Joseph A. Holmes; Coal Resources of Johnstown and Vicinity, W. G. Phalen; How Explosives Will Be Tested, Clarence Hall; Coal Mining at Dante, Va., R. W. Stone; New Mines on Marrowbone Creek, Pike County, Ky., R. W. Stone; Recent Investigations of Illinois Coalfields, Frank W. DeWolf; Government Tests of Coal, Joseph A. Holmes; Statistics Relating to Mine Accidents, Clarence Hall; A Practical Classification for Low Grade Coals, Marius R. Campbell; Some Observations on the Present Statistical Situation in Coal, Edward W. Parker; What the U. S. Geological Survey is doing in the Eastern Interior and Northern Appalachian Coalfields, Geo. H. Ashley; History and Utilization of the Alaska Coalfields, G. C. Martin. Papers by other Institute members are: Concrete in Beehive Oven Construction, Charles L. Hower; A Study in Mining Town Sociology, C. L. Fay; Mechanical Conveyers Applied to Longwall Mining. J. L. Thomas; Why is it that Some Coals Coke and Others do Not? Fred C. Keighley; The Selection and Preparation of Bituminous and Gas Coals for the Market, W. R. Young; Suggestions for a Plan of Taxing Coal Companies and Providing an Accident and Pension Fund—an Extension of the State Mining Department, Samuel A. Taylor; Steel, the Logical Successor of Wood in the Mining of Coal, R. B. Woodworth.

Non-members may secure copies of these proceedings by remitting $2 to C. L. Fay, secretary, Greensburg, Pennsylvania.

Industrial

The cast-iron pipe plant at North Birmingham, Ala., has resumed work.

On April 24 the Crocker-Wheeler Company will move its New York offices to 32 Cortlandt street, in the new Hudson Terminal building.

Chalmers & Williams, Chicago, are now installing complete stamp mill and cyanide plant for Compania Minera El Conde y Anexas, Tepehuanes, Durango, Mexico, including tube mill, rapid cyanide filter and power plant.

The Lorain Steel Company has almost completed the construction of its new mills in Moxham, a suburb of Johnstown Penn. The four new mills, built side by side, are all under one roof and cover from five to six acres of ground.

The executive offices of the Westinghouse Electric and Manufacturing Company, recently at 111 Broadway, and the New York sales and export offices, of the company, recently at 11 Pine street, were removed on April 20, to the new City Investing building, No. 165 Broadway, New York.

The Litchfield Foundry and Machine Company, Litchfield, Ill., has purchased and taken possession of the entire equipment of the Aetna Foundry and Machine Company, of Springfield, Ill., maker of engines, box-car loaders, cages, fans, etc. The transfer includes records and specifications for all engines furnished by the Aetna company, enabling the Litchfield to duplicate orders or furnish repair parts.

The Lehigh Valley Railroad has placed an order with the Cambria Steel Company, of Johnstown, Penn., for 250 steel cars of 100,000 lb. capacity. The air brakes are furnished by the Westinghouse Air Brake Company of Pittsburg, while the springs are to be made by the Lehigh Valley Spring Works, of Johnstown. It will take almost a month to finish this contract, as the daily output of the car shops averages 10 cars per day, while the capacity is 30 cars per day.

The work on improving and enlarging the steel plant of the Tennessee Coal, Iron and Railroad Company at Ensley, Ala., is being pushed. Already the blooming mill has been completed and has resumed operation. The rail mill will be ready for operation again by May, while other departments will shortly be in trim for a resumption of operation, and before the time first anticipated for the work to be completed the full plant will be on. It is stated on good authority that as soon as the improvements are completed there will be a general resumption of operations. Steel rails, in particular, are said to be in demand.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

B. F. Sturtevant Company, Hyde Park, Mass. Bulletin No. 153, Engineering Series. Pp. 8, illustrated, paper, 6½x8 in.; January, 1908.

Hyatt Roller Bearing Company, Newark, N. J. Bulletin No. 31. The Hyatt Roller Bearing Bushing. Pp. 24, illustrated; paper, 6x9 in.; February, 1908.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Pamphlet No. 5. No. 890 Iron Clad Magneto Telephone. Pp. 8, illustrated; paper, 3½x6¼ inches.

Ohio Blower Company, Cleveland, Ohio. Catalog No. 116. The "Swartwout" Cast-iron Exhaust Head and Centrifugal Steam Separators. Pp. 80, indexed, illustrated; paper, 6x9 in.; 1908.

Liberty Manufacturing Company, 6910 Susquehanna street, Pittsburg, Penn. The Liberty Modern Power Plant Appliances for the Efficient and Economic Production of Power. Pp. 58, indexed, illustrated; paper, 6½x9 in.

Goldschmidt Thermit Company, 90 West street, New York City. Shop Instructions for the use of Thermit in Repair Work. Pp. 32, indexed, illustrated; paper, 5x8 in.; 1908. Butt-Welding Wrought Iron and Steel and Pipes and Rods by the Thermit Process. Pp. 12, illustrated; paper, 6x9 in.; 1908.

Construction News

Leastalk, California—A custom mill of 25 stamps is to be put up at Leastalk, on the Ivanpah branch of the Santa Fé road, to serve miners in the Hart district. H. J. Robinson, Los Angeles, Cal., is in charge.

Weaver District, Arizona—The Utah-Arizona Gold and Copper Company will shortly erect a 10-stamp mill. Lafayette G. Burton, of Salt Lake City, Utah, is manager and H. S. Cutler, of the same place, president.

Brown's Valley, California—The Bessie Gold Mines Company has taken up the Bessie mine and intends to introduce electric power for the hoist and other machinery. J. C. Campbell, Brown's Valley, Cal., is the superintendent.

Klamath River, California—The United States Gold Dredging Company has been organized to build dredges on claims on the Klamath river at the big bend of that stream near Happy Camp. Henry J. Barton, of Oak Bar, Trinity county, and W. D. Egilbert, of Redding, Shasta county, are the prime movers of the enterprise, and the owners of the mining ground. The bend in the river referred to is some seven miles long, and the distance across the peninsula thus formed is only about three-quarters of a mile wide. Rich gravel has been found at this place. Guy A. Du Bois is associated with the men named, and is the inventor of the suction type of dredge which it is proposed to use.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Salt Lake City, San Francisco, Denver and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 17—The district attorney of Sutter county has been instructed to begin suits against George Wood, W. B. Simmons, Wm. McGuire and Michael Corcoran, all hydraulic miners, who are reported by Anti-Débris Association agents to be injuring the Bear, Feather and Yuba rivers with débris. It is to be noted that all these miners are carrying on operations under licenses issued by the California Débris Commission, but the recent decision of the Supreme Court has virtually annulled any benefit to be derived from such a license or permit. In this connection it may be stated that L. P. Farmer, who has been for many years manager of the Anti-Débris Association in carrying on its fight against hydraulic mining, has resigned, and his place has been filled by C. R. Boyd.

Charles Strong and H. J. Robinson, of Los Angeles, Cal., have acquired land at Leastalk, at the junction of the Salt Lake main line and the Ivanpah branch of the Santa Fé which runs from Barnwell. On the tract purchased it is the intention to erect a 10-stamp mill to handle custom ores from mines at Hart and other districts served by the Santa Fé and Salt Lake roads. The plant will be equipped with crushers, power, etc., sufficient for a 25-stamp mill. Mr. Robinson will be in charge.

A 14-in. streak of very high-grade gold ore has been found in Atlantic claim No. 2 of the Gold Peak Consolidated Mining Company, at Twenty-nine Palms district, San Bernardino county. On the Boss claim of the same company an 11-in. streak running very high in gold has also been found. The ore has been sacked for hauling to the custom mill at the Palms. This custom mill has now been leased to the company, and a pipe line will be constructed to connect the wells at the Palms with the mines. A new town site has been projected, as these new strikes and others in the Italy and Anaconda properties have created considerable excitement. The Gold Park property is on the boundary line between San Bernardino and Riverside counties, seven miles southwest of the Twenty-nine Placers wells. The new gold ground is 35 miles from the railroad at the nearest point.

The Little Gem mine, on the Merced river, between Merced Falls and Bagby, recently discovered by H. D. Pearson, is yielding some very rich ore. Other claims have now been staked out all around it, but there is still considerable open country all along the river. This strike has been made outside of the Fremont or Mariposa grant, which is closed to prospectors. The territory from Bagby down the river is, however, open to prospectors and miners, being outside the grant. The veins so far found, however, are very small indeed, and appear to hold only pockets near the surface. No depth has been attained on any of them.

The North Star Mines Company, at Grass Valley, is now down over 5000 ft. on the incline on the ledge or course of the vein, and the ore was richer last year than in the previous one, so that over $900,000 was taken out in 1907. The 78,366 tons milled averaged $11.97 per ton; expenses left a net profit of $5.14 per ton. The Kennedy mine at Jackson, in Amador county, is working deeper, with its vertical shaft, than the North Star, with its incline, and continues also in as good ore as at the surface. The North Star was declared about worked out many years ago, and in the sixties it sold for less than half its last year's output. The mine now has upward of $800,000 in its reserve fund for emergencies such as unprofitable years, labor troubles, purchase of other properties, etc. The result of the work of this mine last year is a good advertisement for Nevada county, which is the banner quartz-mining county of California, and was for many years the largest producer of gold until when in 1906, the dredge-mining industry of Butte county brought that county into first place in the yield of gold of the State.

After several years of litigation over the Royal mines at Hodson, Calaveras county, during which the property has been unproductive, the Superior Court has decided the case against the Royal Consolidated Mining Company, and in favor of the Royal Consolidated Mines Company, of California, Ltd., J. C. Kemp van Ee, and John T. Hodson, who were defendants. The decision will probably lead to the reopening of the mine, which is fully equipped with machinery and an extensive milling plant. The body of ore in the mine is of low grade, but wide.

In the old Snow Point placer diggings, a few miles from Alleghany, Sierra county, a 4-ft. ledge of very high-grade free-gold ore has been found by Heggarty Brothers, Work & Eckhardt. These men have been for some time following a stringer which finally led them to the main vein.

The old Banner mine, on Banner hill, near Nevada City, after being idle for a long period, was reopened last year by a new company which holds a bond upon it. The mine was unwatered at considerable expense, new machinery provided, and a good deal of prospecting carried on. Now, the pumps and other underground machinery have been pulled up, and some of the hoists, etc., have been sold. The mine is an old one which in the past has yielded about a million dollars in gold, and it was hoped that its reopening would result profitably. As far as work has gone it has not done so apparently.

The miners of Tejunga district, Los Angeles county, have organized a Protective Association to prevent claim jumping, litigation and feuds. They have also elected a council of seven members for the purpose of arbitrating any differences which may arise in the district. J. A. Russ is secretary of the association, and W. H. Crawford is recorder of the district.

Salt Lake City

April 18—The construction of the new smelter in the Tintic district is progressing steadily; but it is now stated that the initial units of the lead department will not be in commission until June, and it will be July or August before the copper furnaces are ready. The Kelly sintering process is to be used in connection with the roasters and a contract for this equipment has been let.

The United States Supreme Court has denied the application for a rehearing in the noted Kempton case, which involved the ownership of the Kempton lode mining claim in Bingham and which is said to have a valuation of at least $1,000,000. The suit was started a number of years ago by the United States Mining Company, to quiet title which was claimed by E. A. Wall, of Salt Lake. In the first trial of the case, Wall was victorious; but an appeal was taken to the Circuit Court of Appeals and thence to the Supreme Court of the United States, and in each instance the result was a reversal of the verdict decreed by the lower court. The case was stubbornly fought by both sides, and with the possible exception of the Grand Central-Mammoth suit, which involved valuable Tintic property, no mining litigation attracted more attention.

The Newhouse Mines and Smelters Corporation is now operating its mine and mill equipment by electric power transmitted about 60 miles over the lines of the

Telluride Power Company, and has discarded the steam plant at the mill, which, however, will remain intact and held in reserve in case of accidents. The mill is treating 800 tons of ore daily and in addition to the concentrate, 50 tons of high-grade shipping ore are being marketed. A force of 150 men is employed, against 300 formerly, and is accomplishing practically the same results. The inclined shaft is being sunk to the 900-ft. level.

The excavations for the new converter-roasting plant and the additional flues at the lead smelter of the United States Smelting, Refining and Mining Company, have been made; the equipment and material have been ordered. It will be July, however, before any of the roasters are started again. The company will resume the purchase of ore next month.

It can be stated positively that there will be no merger of the Utah Copper with the Nevada Consolidated and Cumberland Ely. The Ely properties may be combined, but Utah Copper will stay out. President Charles M. MacNeill and General Manager D. C. Jackling have so stated. Mr. Jackling has said: "There may be a consolidation brought about some time, but not along the lines indicated in the despatches from the East. Mr. MacNeill made the statement as far back as last January that there would be no consolidation in the near future and that statement still holds good. I am sure of that."

Butte

April 21—The Montana Mine Owners Association has contracted to purchase 51 per cent. of the stock of the smelter at Pend d'Oreille, Idaho, and it is announced that by the first or second week of May the smelter will be ready to receive custom ore. The smelter is well located and has connection with three railroads.

The Boston & Montana smelter, at Great Falls, has been practically shut down pending the rebuilding of 22 miles of Great Northern Railway tracks between Butte and Great Falls, which were washed out by the flood from Hauser lake dam, April 15. While the work on the railroad is being done, the Boston & Montana company is shipping ore to the Washoe smelter, at Anaconda. Hauser lake is owned by the Montana Power Company, which furnished electric power to nearly all the mines and smelters at Butte and Anaconda, and when the power was interrupted by the break of the dam all the mines were compelled to close for a while, some of them for a day or more, until connections could be made with steam-power plants. It is estimated that it will be a year before the damage to the dam on the Missouri river can be repaired. The dam was built at a cost of $2,500,000. The damage is estimated at a million dollars.

Denver

April 18—On the Denver, Northwestern & Pacific Railway (Moffat road) 11 miles of track have been laid west of Yarmony, the temporary terminus, and nearly all the tunnel and rock work between the railhead and Steamboat Springs has been completed, leaving chiefly light grading to be done. Track is being laid daily, and the completion of the line to Steamboat Springs within the year is assured. About 8 miles of this extension will pass through the Oak Creek bituminous coal section of the new Yampa field.

In the milling business in the Cripple Creek district great activity is being manifested, as owing to the low treatment charges of the customs mills, and the erection of several proprietary mills, many of the dumps of the big mines are now being worked over. The monthly output from the district continues to increase, and quite an appreciable influx of people has begun.

Indianapolis

April 20—President Lewis and other officers of the Mine Workers' Association returned to headquarters in this city direct from the Toledo conference April 18 and announced that the result of the joint conference was satisfactory to the miners of the three States directly affected. Of this number 80,000 will return to work at once under a two-year mining contract, the terms of which are practically the same as during the past year. This new contract provides that all internal differences as to prices and conditions of employment shall be referred to the various districts for settlement. The joint conference condemned in positive terms the practice of operators and miners suspending work pending investigation and adjustment of differences, and recommended that such provisions be agreed upon in the various districts as will require mine managers and mine workers to comply with the terms of the contract, and to adjust district troubles without delay and without suspension of work.

The joint conference of Indiana operators and miners will be resumed this week. There is no rushing demand for a signed contract, because Indiana has been at work all the time, but there is not sufficient demand for coal to justify full time operation.

The laborers in Indiana mines insist that they are not getting enough, that $2.56 is not fair pay relatively, but the operators, admitting this, assert that the miner, who receives 90c. a ton, should equalize the pay of the laborer. The Indiana miners are asking for the abrogation of the clause imposing a fine of $1 a day for each day a man is idle by reason of a stampede or illegal strike.

The operators and miners of Illinois had no part in the Toledo conference and will, it is presumed, agree upon a contract satisfactory to all concerned.

London

April 12—In a previous letter reference was made to the application of the directors of the British South Africa company, generally known as the Chartered Company, for fresh capital. The original scheme was not supported by the shareholders, but the amended scheme of issuing 5½-per cent. second-mortgage debenture stock has been sufficiently subscribed, and allotment letters have been posted.

The diamond mines of South Africa are experiencing bad times. The three leading producing companies; the De Beers, the Jagersfontein and the Premier (Transvaal) Diamond Company, have made in the past enormous profits, and a year ago there did not seem to be the remotest chance of their prosperity being disturbed. The market for the stones, however, has lately fallen off to such an extent that a general curtailment of production has been found necessary, together with a suspension of the payment of the customary dividends. The collapse in the diamond market is attributed to the recent financial crisis in America, which country has been the best customer for diamonds, but has now ceased buying to any large extent. The return of commercial prosperity will no doubt restore the market to its normal condition; but meanwhile, the South African mines are placed in an embarrassing position, as operating expenditures must be met, while the stock of diamonds, for which there is no sale, grows larger day by day. The diamond business has in the past been controlled by a syndicate, which by regulating the supply, has kept up the price. The falling off in sales may perhaps be the result of too high a price. That, at all events, is the suggestion of the ex-mayor of Kimberly, R. H. Henderson, who advocates an all-round reduction in price so as to widen the market. The diamond business has been more or less a monopoly. If, however, the occurrence of diamonds is not so limited as has been supposed, the monopoly must break down and the price of diamonds will then be regulated by the ordinary laws of supply and demand. The price will depend on the cost of production and the profit that the mines consider a fair return on the capital invested. The De Beers Company has now a formidable competitor in the Premier mine of the Transvaal. The two companies have so far coöperated in regulating the supply of diamonds. The agreement, under which the Premier mine sold its output through the syndicate that controls the De Beers sales, expired on March 31 and it is possible that it may not be renewed. If not, the two companies will compete for trade.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

YAVAPAI COUNTY

Big Stick Mining Company—This company, which recently purchased the Howell group of mines in the Santa Maria district, has now also bought the properties of the Sultan Mining Company including the 20-stamp mill and the 75-ton cyanide plant. The mill will be removed to the Howell group at once.

California

CALAVERAS COUNTY

Esperanza Channel—This mine, three miles from Mokelumne Hill, is producing very rich gravel. It is owned by S. L. Davidson.

Nuner—Work has been resumed at this gravel mine, Mokelumne Hill. An upraise is being made in the old tunnel to tap the upper channel.

Ritter—This mine at Mountain ranch has good ore on the dump and will erect a mill.

EL DORADO COUNTY

Gignac—At this property, W. W. Stone, manager, a good body of high-grade gravel is being breasted out. Ten stamps will soon be used on this cemented gravel.

HUMBOLDT COUNTY

Patrick Point—At this new copper property near Trinidad, several hundred tons of ore have been taken out, but it will not be shipped until prices in copper advance.

INYO COUNTY

Kruger—This new mining camp has been established four miles southeasterly from the old mining town of Keeler. What seems to be the mineralized area is about two miles long and half a mile wide. For over 20 years claims at this point have been located and relocated and abandoned, no one of the miners going to any depth. The character of ore is much like that at Bishop, in the same county. The general outlook of the new camp is encouraging; some ore is being shipped and a number of leasers have been set at work on the more promising claims. What seems to be the largest property so far is the Poland group of 16 claims owned by J. H. Thompson, L. H. Briggs and C. F. Marcy. The camp is four miles from a railroad, and there is water near by which may be pumped.

Keeler—The projected reopening of the old Cerro Gordo mines and smelter is having the effect of reviving interest in mining affairs at Keeler. The Four Metals Company, which is preparing plans for an aërial tramway from the Cerro Gordo mine to the smelter intends to purchase ores from outside parties as soon as the smelter is ready for operations, and this announcement is encouraging prospecting and development on both sides of the valley.

Southern Belle Mines Company—A. E. Gall has been elected president and general manager of this company to succeed A. E. Vandevark, and Charles Gall is appointed superintendent. At the Bullion claim at the south end of the group it is proposed to erect a Huntington mill and a cyanide plant.

MADERA COUNTY

Rex—At this mine, Grub gulch, owned by John Day, rich ore has recently been found, which is being crushed in the local mill.

NEVADA COUNTY

Jenny Lind Mining Company—After having paid 40 assessments on the stock of this company, the stockholders will now pay one of 5c. a share before they get anything out of the gravel channel recently struck in the mine. The gravel found is of high grade.

PLUMAS COUNTY

Asbestos—John Edwards has discovered a deposit of asbestos 10 miles east of Quincy.

Bonnie—The Reno syndicate has made a payment of $5000 for this hydraulic mine on Poorman's creek.

RIVERSIDE COUNTY

Indio—Several small companies are working north of this camp. The Gold Acres company has installed a five-stamp mill and is now ready for crushing. The German-American company has taken out considerable good ore, as has the El Dorado company. The Gold Park company is hauling ore to the mill at Twenty-nine Palms.

SAN BERNARDINO COUNTY

Twenty-nine Palms District—High-grade free-gold ore has been found in this district, and many prospectors are excited over the find.

Kane Copper Mining Company—At this property, six miles west of Needles, F. P. Pingree manager, the pump has been installed and a good body of ore has been struck.

Delamar—It is understood that this mine, near Baldwin lake, has been sold by Mr. Delamar and that the 40-stamp mill will be moved to a lower point near the lake and the capacitiy largely increased.

Homestake—This mine, on Taylor creek, Salmon River district, owned by F. H. Osgood, of Seattle, Wash., has been taken over by a New York company, which will begin extensive development work.

Taylor Lake Mining Company—At this property the vein has been tapped in the new crosscut tunnel driven last winter. This is 250 ft. below croppings. There is a small mill at the mine.

TRINITY COUNTY

Bonanza King Mining Company—At this mine, Trinity Center, Jos. Porter superintendent, operations are being resumed, arrangements having been made with the men to whom wages were due.

Colorado

DOLORES COUNTY—RICO

Atlantic Cable—The Pro Patria mill of the United Rico Mines Company is just completing a run on the complex zinc ore from this mine. After wet concentration and separation on Wilfley tables the zinc product is roasted and put through magnetic separators. The concentrates have not yet reached the magnetic plant, but the result will be known in another week. The finished zinc product, it is estimated, will be from 40 to 50 per cent. in grade.

Dolores Mountain—The policy of the United Rico Mines Company in leasing its Ute territory on Dolores mountain is proving a success. Four or five leasers have ore ready for shipment as soon as the roads will permit hauling. A considerable amount of milling ore has been put in the company bins by leasers at a nominal sum per ton.

Shamrock—The large body of lead-zinc ore recently disclosed in the Shamrock ground of the Atlantic Cable area continues to increase in dimensions with development. The orebody has been proved for a length of 240 ft., a width of 20 ft., and a depth of 36 ft. without finding top, sides or bottom. The ore is a lead-zinc replacement in dolomite lime. Along the tunnel level the lead predominates, but as depth is obtained by winzing the percent-

age of zinc increases. The zinc is a clean rosin zinc, and in spots the replacement of the lime by the lead and zinc is almost complete. The Shamrock ground lies almost west of the Atlantic Cable mine on the opposite side of the river. The trend of the orebody is east and west, and as the general characteristics and trend of the deposit are the same as in the Atlantic Cable deposit—although the Shamrock is less complex—it is thought that it is a part of or intimately connected with the latter. Development is progressing with air drills.

LAKE COUNTY—LEADVILLE

Emmet—Work has been started on this old property on Yankee hill by E. A. Smith. Men are employed repairing the shaft and putting the machinery in order. At present the work is rather in the nature of prospecting.

Fanny Rawlings—Work is being pushed in uncovering the orebody recently struck in this mine. It promises to be of considerable extent.

Modoc—Lessees are working this mine on Carbonate hill, and shipments will soon begin.

Sokwin District—Work is progressing well on the several new enterprises in this district.

LA PLATA COUNTY

Champion Coal Mine—An explosion in this mine on April 14 damaged the mine, killed one man and injured two others. The mine was closed pending an investigation. The superintendent has stated his belief that the explosion was caused by dynamite, and that it was the work of someone employed in the mine.

TELLER COUNTY—CRIPPLE CREEK

Anchoria-Leland—The strike made by Smith Brothers, lessees, on this property, is showing up very well.

Bonnie Nell—Work has been resumed on this group on Raven hill. H. H. Barbee is in charge.

Doctor-Jack Pot—Some rich ore is being taken from the seam opened up by the Lucky Corner company, leasing on this property.

Henry Adney—Another vein has been opened on this property at about 500 ft. depth. The vein is rich, but not as wide as the two recently opened between the fifth and sixth levels.

Idaho

SHOSHONE COUNTY

Federal—This sampler has resumed operations after having been closed since about the first of the year. Between 20 and 25 men are employed and several cars of ore have been shipped down from the mills.

Rex—At a meeting of the parties interested in the lease on this property, it was decided to incorporate a development company. Development work is progressing at the mine and an electric hoist will be installed. It is stated that there is now enough ore blocked out to keep the mill running one shift until the contemplated development work is completed.

OWYHEE COUNTY

Traders—Orders have been received to start work on this property. Conditions are such that only a small force of men can be worked.

Illinois

ZINC-LEAD DISTRICT

Galena—The Vinegar Hill is now shipping zinc ore regularly. The Appleton-Galena has again started milling, and the Black Jack, Northwestern and others are expected to resume operation soon. The Joplin separator works, which closed down a short time ago, will start up again. This company buys raw concentrates from low-grade zinc producers, roasts the ore and sells the finished product to the smelters.

Indiana

Oil mining in Indiana is increasing at a rapid rate and the operators are procuring good results. The Princeton field in southwestern Indiana, the Petersburg field in Pike county, and the Montpelier field are being developed to such an extent as to bring oil men from all over the country to these fields, and some leases are being sold at fabulous prices. There were 15 new wells completed in Indiana during the past week and the product is very satisfactory.

Kansas

ZINC-LEAD DISTRICT

Lynch & Williams—A good lead strike has been made on the land of Windle Brothers, on Wall street, Galena, at 125 ft. depth.

M., K. & T.—This mine at Baxter Springs has started up and will take its place again as one of the regular producers.

Michigan

COPPER

Lake—Drifting has started on the vein at the bottom of the shaft, which is down 160 ft. The shaft has gone down in extremely rich ground.

Dollar Bay Smelting Works—At this plant, which is owned by the Bigelow interests, the third large furnace is ready to go into commission. This furnace will, in all probability, be used on the mineral from the Ahmeek mine.

Seneca—Diamond drilling is being continued on this tract and a complete cross-section will be obtained. Development at the Ojibway on the north and the Gratiot on the south are proving this property.

Mohawk—The new Nordberg compressor at No. 4 shaft will go into commission as soon as the bank of boilers is completed to furnish steam for this plant. All air for mining will be furnished from this central plant.

Missouri

ZINC-LEAD DISTRICT

Mining has been resumed in the bottoms between Joplin and East Joplin, after many years of idleness. The water has been beaten and several turn-ins made.

Cale Land—A good strike of silicate has been made at a shallow depth on the Cale land near the Optimo mine, at Sarcoxie.

Federated Mining Company—This company has completed a new mill at its Thomas D. mine No. 2, at Peacock, and has built a long tramway to the southeast shaft. An air drift connects the two shafts and the mill will soon begin steady production.

John D. Lead and Zinc Company—This company has made a rich strike on the Connor land at Prosperity. The dirt has been running about 30 per cent.

Malang & Matthews—Ammerman & Co. have secured a 20-acre lease on the Malang & Matthews land and will soon start operations. A 20-ft. face of ore has been found.

Regina—This company has made a lead strike at its mine on the Guinn land, north of Webb City. It has made several runs of 2½ tons of concentrates an hour.

Montana

BUTTE DISTRICT

Parrot—Work has been resumed after a period of inactivity dating from last October. Several hundred feet of the shaft have been retimbered. Development work will be resumed and mining will be carried on to the extent of about 300 tons of ore per day. About 200 men have been put to work. The Parrot company also operates the Little Mina from which 100 tons of ore are mined per day.

Butte & Superior—The shaft is down 1050 ft. and a large station is being cut on the 1000-ft. level. It is possible that a north crosscut will be run from this station, but this has not been fully decided. When the station is completed sinking will be resumed and carried to the 1200.

Butte-Balaklava—The stations at the 700 have been completed and crosscutting will soon begin. The company expects to find ore at this level, especially in the Edith May vein, on which the North Butte company is doing its most extensive mining.

British-Butte—Development work on the company's big placer property is steadily going on and the tests continue

satisfactory. Good assays are obtained from every foot of ground opened.

BEAVERHEAD COUNTY

Dillon-Argenta—A compressor plant has been purchased and will soon be installed at this property. The company will push development work. The Argenta district has been a producer for the last 40 years.

Banner—This and several other claims in the Argenta district have been leased to an Eastern company. The properties were extensively worked for gold in the early days.

Butte-Knickerbocker—A force of men has been put to work on the Golden Leaf group, under option by this company. Development work will be prosecuted and the stamp mill remodeled and enlarged.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Ore Production—During the week ending April 11, 1870 tons of ore were shipped of a total value of $193,855. The Western Ore Purchasing Company received 820 tons from the following mines: Little Florence, 170 tons; Rogers Syndicate, 418 tons; Sandstorm dump, 100 tons; Hayes & Monette, 12 tons; Combination Fraction, 120 tons. The Combination mill treated 595 tons, and the Nevada-Goldfield Reduction Company 455 tons, received from the following mines: Jumbo, 181 tons; Begole Syndicate, 250 tons, and the New Western, 24 tons.

Crackerjack—Work on this property will be resumed with three shifts. The shaft is down 300 feet.

Great Bend—Loftus & Davis in their lease on this property in the Diamondfield section, have developed a ledge varying from 1 to 2 ft. wide yielding assays from $40 per ton and higher, silver and gold. The orebody has been developed for a distance of 125 ft. on the 300-ft. level. A winze has been sunk 50 ft. on the vein and a crosscut on the 350-ft. level shows the same material. The Great Bend is near the Daisy mine.

Goldfield-Golconda—This mining and leasing company has been reorganized. The officers have resigned and the stock has been surrendered into the possession of F. P. McNeil and associates, who have taken over the leasehold block 10 of the Golconda, as well as block 9, which was recently forfeited.

Little Florence—The leasing company is working three shifts and is paying the miners a bonus in its efforts to take out as much of the high-grade ore in its stopes as possible before its lease expires at midnight April 26. At this rate it does not expect to take out any of the milling or medium ore that has been developed.

Nevada-Empress—At this mine in the old Oriental district, south of Goldfield, a 40-ton mill is to be installed, the capacity to be increased later. The plant will be erected on the Central claim.

Mohawk—While engaged in tracing an apex the Consolidated company cut two new orebodies in the northeastern portion of Mohawk No. 2. The ore is said to compare favorably with that of other parts of the mine.

Sandstorm—Ore sacking has been resumed on the Waterman sub-lease of the Parkinson leasehold. L. A. Harbaugh and Frank Champion have secured a lease on block 1 of the mine.

LYON COUNTY

Nevada Douglas Copper Company—At a special meeting of shareholders, a bond issue of $600,000, bearing interest at the rate of 6 per cent., has been authorized by this company, operating at Yerington. The bonds fall due in five years, but are redeemable in stock at the rate of $7.50 a share within three years. The proceeds are to be applied in clearing up the present indebtedness and for the purchase of more equipment. The headquarters of this company are in Salt Lake City, Utah.

NYE COUNTY—BULLFROG

Alliance—The contract will soon carry the shaft down to the 400-ft. level when lateral exploration is to begin. The company owns 85 acres of patented lands into which veins from the Shoshone and the Montgomery Mountain are believed to enter.

Bullfrog Pioneer—This company will start up its new cyanide plant as soon as certain necessary parts arrive. The hoisting engine and the timber for the gallows frame are on the ground.

Montgomery Mountain—Two shifts of men began work opening the mine last week. A few men have been at work for some time cleaning out the workings. A compressor and two hoisting plants have been ordered.

Montgomery-Shoshone—Nine bars of bullion, representing 21 days' accumulation in the zinc boxes, and having an approximate value of $42,000, were shipped to San Francisco April 10. In addition 40 tons of concentrates were sent to the smelters. The mill is treating about 175 tons of ore daily, and shipments of high-grade ore are made regularly.

NYE COUNTY—MANHATTAN

Big Chief—The ore from the development of the body found a few days ago on the 40-ft. level 25 ft. out from the shaft is sacked as rapidly as it is broken. This quartz shows free gold and the vein resembles that of the Union No. 4 claim.

Earl—A crossledge has been encountered at the Forman lease and a parallel vein has also been uncovered. A run of ore from this lease is being made at the plant of the Cañon Milling Company.

NYE COUNTY—TONOPAH

Ore Shipments—Shipments over the Tonopah & Goldfield Railroad for the week ending April 11 to the Western Ore Purchasing Company, included 150 tons of ore from the MacNamara and 90 tons from the Tonopah Extension. The Tonopah company sent 3700 tons, the Belmont company 600 tons, the Montana-Tonopah 1100 tons, the Jim Butler 240 tons and the Midway 200 tons to the mills, making the total shipments 6080 tons.

Jim Butler—Work is confined to the stopes in the old Fraction No. 1 claim. Ore is stoped at several places on the 250-ft. level from the Wandering Boy vein east of the Old Fraction shaft, the ledge varying from 2 to 8 ft. wide. No sorting is done, the ore being shipped as stoped to the Belmont mill. About 35 men are employed.

Montana-Tonopah—More than 140 ft. of new work has been done in the mine during the week. Work has been resumed in the 392-ft. level. The faulted portion of the Macdonald vein, recently picked up on this level, is yielding good milling ore. The stopes on the 515-ft. level south of the shaft continue to yield high-grade ore, the vein showing 4 ft. of rich material. The A-B-B. vein which was faulted on the east on the 665-ft. level has been picked up; it shows 4 ft. of high-grade ore.

MacNamara—Development is limited to a block of ground in which the injunction served by the West End Mining Company permits operation. The trial of this case which was set for April 20 has been postponed until August 3 next.

Tonopah-Belmont—Two new orebodies have been cut, one on the 700-ft. level and the other on the 900-ft. level, both showing good quality of ore. At the mill eight new Johnson vanners are being installed to treat the slimes.

Tonopah Mining—The big Mizpah vein has again been picked up on the 500-ft. level. Some time ago the ledge faulted about 800 ft. east of the shaft, and after crosscutting along the fault about 180 ft. the orebody was again found. The vein as far as developed shows good ore. Much development work is in progress in the mine. On the 900-ft. level of the Silver Top claim connections are being made preparatory to sinking the shaft to the 1300-ft. level. The mill during the week crushed 3313 tons of ore of an average value of $24 per ton at an average extraction of 89 per cent.

WHITE PINE COUNTY

Steptoe Plant—Half of the first unit of the new concentrator began operations April 19, treating 350 tons of ore in four hours. The operation of the unit proved entirely satisfactory.

Oklahoma

OTTAWA COUNTY

Old Chief—This mill at Miami has made a trial run and is now ready for steady operation as soon as development warrants.

Pennsylvania

BITUMINOUS COAL

Berwind White Coal Mining Company—This company has just added 20 new 13-ton electric locomotives to its equipment in the Windber district. They were finally inspected a few days ago by W. M. McKee, who represents the manufacturers, the Jeffrey Manufacturing Company, of Columbus, Ohio.

South Dakota

CUSTER COUNTY

Hartwell—President Hart has raised funds in Ohio to commence operations at once, to develop the property near Custer and to build a mill.

LAWRENCE COUNTY

Ada May—Near the Wyoming border line, Sol Burns, of Terry, and associates are planning to do extensive placer work on 100 acres near Sand Creek. The ground will be washed for 1500 ft. to bedrock. It is noted for gold nuggets.

Finlander Group—Eastern interests have bonded the 100 acres in the Custer Peak district for $30,000 and will commence operations at once. A new company is to be organized and a shaft sunk.

North Homestake—F. R. Baldwin, for six years past, manager, has retired and is succeeded by John Gross, formerly of the Mogul company. The North Homestake has resumed operations.

PENNINGTON COUNTY

Cochran—Recent development shows an extensive mineralization throughout the property near Rochford and five ledges containing free-milling ore. The mill will be started up in a few weeks.

Utah

BEAVER COUNTY

Little Beaver Mining and Reduction Company—This company, for a consideration of $40,000, has purchased the Marguite and other claims of the Vicksburg Gold and Copper Company, situated in this county.

JUAB COUNTY

Developments being made at depth in the older mines of the Tintic district are attracting much attention. Some of the older properties which a few years ago were supposed to have been worked out, are opening up bigger and better than ever. This has been the case without a single exception and the Mammoth, Centennial Eureka, Gemini, Bullion Beck and Eagle & Blue Bell have been especially prominent. The Mammoth now has the deepest workings of any mine in the State, being developed to the 2300-ft. level; the Gemini is down 2000 ft., the Centennial Eureka about the same distance; the Eagle & Blue Bell is below the 1300 and the shaft is still going lower. While this improvement is being made at depth in the older properties, the recent development of new mines has proved the district to cover a much larger area than was supposed a few years ago.

Little Chief—The management has decided to sink the shaft at this mine to 1000 ft. depth.

May Day Mining Company—The annual meeting resulted in the election of all but two of the retiring directors. John Dern, of Salt Lake, has been made president. Last year, 153 carloads of crude ore and 15 cars of concentrate were marketed; the former bringing an average of about $1000, and the latter $1500 a carload. Six dividends were paid, totaling $64,000, and on April 1, the company had a cash balance on hand of $9084. The May Day mine is in Tintic.

Mammoth—Although no ore has been marketed this year, mine development has progressed. About 4000 tons of ore have been broken for shipment.

Swansea—The mine equipment at this property is being overhauled, preparatory to a resumption of operations.

Tintic Shipments—Shipments last week amounted to 77 carloads, the contributing mines and amounts being: Centennial Eureka, 49; Eureka Hill, 13; Bullion Beck, 6 cars.

SALT LAKE COUNTY

Utah Copper Company—Operations in February were interrupted by several accidents, which caused the concentrating mill to be idle seven days. The production for the month is said to have been 2,176,000 lb. of copper, costing 10.47c. per lb. The average cost per pound for the three months ending Feb. 29 was 9.06c. It is expected to be another year before the maximum recovery, about 28 lb. per ton, will be secured, the ores first coming from the steam-shovel work being of lower grade than the average, because of their proximity to the surface.

SUMMIT COUNTY

Ontario Drain Adit—The water in Ontario No. 2 shaft has lowered to a few feet below the 1400-ft. level, leaving less than 100 ft. to be drawn off to reach the adit level. The great avenue, which has been closed by caves for more than three years, will be open before the end of April.

Park City Zinc Plant—The treatment of middlings from the Daly-Judge mine in the concentrator erected by the Grasselli Chemical Company, has commenced. Treatment is given to 50 tons a day.

Wabash—This company is preparing to begin the production of ore.

Washington

Coal production for the full year is reported by the State mine inspector at 3,293,098 short tons in 1906, and 3,713,824 in 1907; an increase of 420,726 tons, or 12.8 per cent. The larger producing counties last year were: Kittitas, 1,524,363; King, 1,446,602; Pierce, 616,120 tons.

FERRY COUNTY

Byrne—This mine at Keller resumed operations recently. Two shifts are working on a drift, a vein having been discovered carrying gold and silver.

First Thought—A new strike of rich ore is reported from this mine at Orient. The shoot is about 4 ft. wide, and carries gold. The First Thought is now shipping about 700 tons of ore monthly to the Trail and Northport smelters. Until the closing of the Sullivan smelter much of its ore was going to that plant. Development work is being steadily prosecuted. About 40 men are being employed.

Sunset Mining and Milling Company—This company at Keller, is now preparing to resume work on a group of five claims which it has been developing for several years. A shaft, adit and open cuts along the entire length of the property have opened up some good copper ore.

West Virginia

GILMER COUNTY

Cosmopolitan Coal and Coke Company—This company has secured control of a tract of 11,000 acres of coal land and is preparing to begin its development. The first work will consist in the opening of a mine and the building of 100 coke ovens. The company has arranged for the issue of $300,000 mortgage bonds, of which $150,000 will be put out at once. The railroad connections will be over the Baltimore & Ohio.

Wisconsin

ZINC-LEAD DISTRICT

Mineral Point—The Merry Christmas, Harris, Hoare and John Ross are now producing at this camp. Concentrating plants were completed last fall on the first three properties. The Mineral Point Zinc Company is rebuilding and remodeling its oxide department and will resume making zinc oxide in the near future.

Platteville—The Hodge, Empire, Acme, Royal, Weigle, St. Rose and Graham-Stevens are producing. The first four are equipped with roasters and turn out a grade of ore testing 60 per cent., and better, in zinc. The Homestead is receiving the mill equipment purchased from the Hibernia. The Lyght company has decided to build a new mill. Considerable prospect work is also under way in this camp. The new Blake-Huff electro-

static separator is operating daily, but not at full capacity. Between 30 and 50 tons of finished concentrates are run through daily.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending April 11 were as follows: Kerr Lake (Jacobs), 60,330 lb.: La Rose, 226,800; McKinley Darragh, 103,780; Nipissing, 43,260; Nova Scotia, 40,000; O'Brien, 63,810; Temiskaming & Hudson Bay, 43,260; total, 581,260 pounds.

Badger—No. 6 shaft is down 100 ft., at which depth the vein is 15 in. wide and rich in leaf silver. Shaft No. 5 is down 150 ft. Drifting has begun at 70 ft., and a new level has been started at 140 feet.

Cobalt Central—A force of men has been started at surface work on the location east of the Big Pete at Glen lake. A vein 2 ft. wide composed of calcite carrying some silver was found and a shaft will be sunk for 100 ft. The main shaft at the Big Pete is down 200 ft., and three veins are being worked at the 75- and 150-ft. levels.

Foster—George H. Doran, managing director, has returned from a European trip and reports having entered into exceptionally favorable arrangements for the disposal of both high-grade ore and cobalt ore abroad. Shipments will begin at once. The machine shop and assay office at the mine were burned on April 12, entailing a loss of $3000, fully covered by insurance. No delays will ensue.

Nipissing—The second annual report of the Nipissing Mines Company states that during the 11 months, from Feb. 1, 1907 to Dec. 31, 1907, the income from ore production, including ore on hand, in transit and in process of refining was $1,298,636 compared with a similar item of $1,298,636 in the period from May 1, 1906 to March 31, 1907.

ONTARIO—SILVER CENTER DISTRICT

Forneri Claim—About 1400 ft. of stripping and trenching have resulted in the discovery of a good cobalt vein varying from 1 to 14 in. in width and carrying small amounts of silver. Some smaller cobalt veins have also been found.

Keeley Location—It is reported that this property, the pioneer claim of the new camp, has been purchased for $300,000 by Dr. Beattie Nesbitt, of Toronto, for a syndicate of Chicago capitalists.

Maiden Claim—A good cobalt vein 14 in. wide in some places has been exposed for several hundred feet. It is stated to carry good silver values.

Proudfoot Location—This property adjoins the Keeley Location and the Keeley vein has been found by trenching.

ONTARIO—LAKE OF THE WOODS DISTRICT

Black Eagle—Instructions have been received from England to have this gold mine unwatered, preparatory to development on a large scale. Satisfactory financial arrangements have been effected. The present depth is 500 ft., and the quality of the ore is well maintained.

ONTARIO—LARDER LAKE DISTRICT

Harris-Maxwell Company—A gold bar valued at $200, representing the results of a 10-hr. run, has been received in Toronto. Operations were suspended on account of the breaking down of the crusher before the run was completed.

Mexico

CHIHUAHUA

Izola—The adit has cut the vein at 140 ft. at this property at Arroya Honda near Ocampo. The vein is 7 ft. wide at the point of intersection.

La Republica—The cyanide plant has been completed and will be started within a few days. It will have a capacity of 50 tons per day. A 10-stamp mill is working steadily. The mine employs a force of about 175 men.

Lluvia De Oro—Owing to the difficulty of transporting the machinery the 100-stamp mill may not be completed during the present year. It appears that this machinery was brought in over the Kansas City, Mexico & Orient railway from Topolobampo. It was then transported to Choix, thence part of it has been carried over a wagon road built by the Lluvia de Oro company about 20 miles to a place called Mesa Colorada, on the El Fuerte river. Here an effort is to be made to raft by pulling, with engines and hawsers, the machinery up this mountain stream about 15 miles or more to a place called Guaymucha. From there the Lluvia de Oro company has built a narrow wagon road up to the mines, a distance of about 12 miles.

COAHUILA

Compania Minera de San Juan—This company of Saltillo has bought the silver-lead properties of the Gonzalez family at Mapimi. The purchase price is said to have been $350,000. None of the properties has been worked on a large scale.

JALISCO

Lawson Mexican Company—This company, with a capital stock of $5,000,000, has been formed to develop and operate the properties owned by Thos. W. Lawson in Mexico. The holdings include El Moral group of quicksilver mines in the Mascota district, nine gold-silver properties in La Navidad and options on 12 others, and La Dorotea copper mine in the Zapotlan district.

Mexican Mines-Prospects Company—This company has secured the San Luiz del Oro group of properties in the Hostotipaquillo district and the Juan-Quiniquila near San Marcos.

Tajo—A reduction plant with a capacity of 30 tons per day will be erected at this mine in the San Sebastian district. The plant will consist of stamps, concentrating machinery and a cyanide annex.

El Oro—The Exploration Company, Ltd., of London, makes the following statement for operations during the month of March: The mills ran for 30 days and crushed 23,238 tons of ore, yielding $206,751 in bullion; expenses were $101,645 and expenditures on developments were $17,022, leaving a net profit of $88,084; profit on railway $8390; total profits $96,474; expended on permanent improvements $6372, and on the San Patricio shaft $3670.

SONORA

Greene-Cananea—There are about 900 men on the payrolls and the work of preparing the plant for operations is progressing as rapidly as possible.

Fay-Cananea Copper Company—Shipments of copper ore to the smeltery at El Paso have begun and it is expected will continue at the rate of two cars a week. The ore is from the sulphide group in the Sierra Azul about 25 miles south of Cananea.

Arizpe—The property in the Manzanal mountains about 15 miles from Cananea is in good copper-silver-gold ore in both shafts. Work has been continued, and more men are being added to the force.

Creston-Colorada—The plant of this company and that of the Chas. Butters Company are at present the most important operations at Torres, the Grand Central company having wound up its affairs at that place. The Creston-Colorada Company has leased the mill and cyanide plant of the Butters company, and is treating 5000 tons of old accumulated mill slimes per month besides treating 225 tons of ore daily in its own plant.

Africa

TRANSVAAL

The labor statement for March shows that during the month 15,245 Kafirs arrived at the mines, while 4015 left on expiry of their contracts. The total number reported March 31 was 137,075, or 11,230 more than Feb. 29. In March, 1902 Chinese were sent home, leaving 26,504 at work March 31. This is just about half the number employed 10 months ago, on May 31, 1907, when 53,049 Chinese were reported.

Australia

WESTERN AUSTRALIA

Gold production in March is reported at 129,326 oz. fine, being 2170 oz. less than in February. For the three months ended March 31 the total was 426,157 oz. in 1907, and 410,641 oz., or $8,487,949, in 1908; a decrease of 15,516 oz. this year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, April 22—The situation in the West is favorable. The conference at Toledo agreed upon a two-years' contract at present rates, and there is no doubt that this will be approved by the miners, to whose vote it has been referred. Mining will be resumed May 1, wherever it has not already been started. Illinois remained out of the convention; its operators and miners have not yet agreed upon their local contract, the main question at issue being the payment of shot-firers.

In the Southwest, Texas miners and operators have agreed to adopt the old contract for another year. The other States are approaching a settlement.

Business throughout the West continues light. The demand for steam coal is small, and there is little talk of the Lake trade yet, though the season is now well advanced. The cessation of mining has not, on the whole, been unwelcome to operators.

In the East, the bituminous trade is very quiet. The anthracite trade shows a little life, an unusual number of buyers taking advantage of the summer discounts.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to April 11, in short tons:

	1907.	1908.	Changes.
Anthracite	1,508,213	1,451,137	D. 57,076
Bituminous	10,508,027	9,329,117	D. 1,178,910
Coke	3,945,335	1,970,634	D. 1,974,701
Total	15,961,575	12,750,888	D. 3,210,687

The total decrease this year was 20.1 per cent.; decrease in coke, 50.1 per cent.

Coal receipts at Boston, three months ended March 31, as reported by Chamber of Commerce, in long tons:

	1907.	1908.	Changes.
Anthracite	476,576	389,904	D. 86,672
Bituminous	653,064	824,000	I. 170,936
Total domestic	1,129,640	1,213,904	I. 84,264
Foreign	127,649	142,350	I. 14,701
Total	1,257,289	1,356,254	I. 98,965

The larger part of the foreign coal comes from Nova Scotia.

The production of anthracite coal, by districts, for the full year was, in long tons:

	1906. Tons.	1906. Per Ct.	1907. Tons.	1907. Per Ct.
Schuylkill	16,011,285	28.8	20,141,288	30.0
Lehigh	7,046,617	12.6	8,329,653	12.4
Wyoming	32,640,692	58.6	38,638,452	57.6
Total	55,698,594	100.0	67,109,393	100.0

For eight years past the proportion furnished by the Schuylkill region has been nearly stationary. The Lehigh has decreased from 15.3 to 12.4 per cent. of the total, while the Wyoming has increased from 54.7 to 57.6 per cent.

New York

Anthracite

April 22—Prepared sizes continue active and the demand is brisk; advantage is being taken of the reduced price. Small steam sizes are dull, with the exception of pea coal, which is in short supply. Prices are as follows: Broken, $4.25; egg, stove and chestnut, $4.50; pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.65@2; barley, $1.35@1.50; all f.o.b. New York harbor. The prices on steam coal are not the circular prices, but are for coal sold by independent dealers and the price depends largely upon quality.

Bituminous

The soft-coal trade along the entire Atlantic seaboard is practically at a standstill. In the far East business is especially dull and there seems to be no disposition on the part of the consumer to call for first orders on new contracts; indeed there seems to be an inclination to allow stocks to run entirely out before ordering. Trade along the Sound is taking more coal than other territories, but the trade needs continual urging and does not take coal voluntarily.

New York harbor is extremely dull, no business worth speaking of having been done for several weeks. Transportation from mines to tide is slow, but no complaints are being made on this account. There are plenty of cars for all purposes. In the coastwise-vessel trade small vessels are scarce. Among the larger craft there seems to be a disposition to tie up rather than to accept the low prevailing freight rates. Freight rates are as follows: To Boston, 60c.; Salem and Lynn, 65@70c.; Portland, 60@65c.; Newburyport, 75c.; Portsmouth, 65c.; Saco, $1 and towage; Bath, 70c.; Gardiner, 75c. and towage; Bangor, 75@80c., Sound points, 50@55c. These rates are for large vessels.

Birmingham

April 20—Coal production in Alabama promises to improve. It is stated that three or four of the larger mines in the Pratt Mines division of the Tennessee Coal, Iron and Railroad Company will be started up.

The Alabama Fuel and Iron Company has been incorporated in Birmingham. The object of the company is to acquire lands containing coal, iron ore, limestone or other minerals; to engage in the mining business, to construct and operate blast furnaces and steel plants; also to manufacture pig iron and steel. The capital stock has been placed at $2000, with the privilege of increasing it. The officers are Walker Percy, president; W. T. Dillon, secretary and treasurer; Spier Whitaker, director.

No change is reported in the coke situation. The prospects remain unchanged.

Chicago

April 21—The coal market continues dull, notwithstanding the shortage of supplies caused by labor troubles. Manufacturing consumers are running on short time and domestic demand is naturally light in April. Many retailers are stocked heavily yet and railroads are assured of supplies. Fine coals are in demand and prepared sizes almost without exception are weak. The general demand for coal is increasing slightly and contract making is progressing, despite the slackness of open-market buying.

Lump and egg from Illinois and Indiana mines sells at $1.75@2.25; run-of-mine at $1.50@1.75 and screenings at $1.40@1.60. Brazil block has a light supply and demand at $2.60@2.75. Coals from east of Indiana are not in good demand. Smokeless is slightly under circular prices for lump or run-of-mine, and Hocking finds a market for only small lots at $2.75@3.25. Youghiogheny and Pittsburg No. 8 are out of the market.

Pittsburg

April 21—While the settlement of the mining scale for a period of two years on the basis of the old scale is entirely satisfactory to both sides there is no haste in resuming operations. A few of the railroad mines opened yesterday, and today it is estimated that not more than 20 per cent. are in operation. The river coal mines are practically in full operation. The rivers have been navigable for over a week and nearly all the coal loaded in the pools and harbor has gone to the lower river ports. Many empty boats and barges have been returned and active operations will be continued for some time. No shipments are being made to Lake ports for the North-

western markets as the docks are filled to their capacity and there are no boats available. The ore tonnage will be greater than the amount of coal required so there will be no difficulty in filling all the coal contracts. Prices remain unchanged and are firm on the basis of $1.15 for mine-run coal at the mine and $1.20 on current business, all f.o.b. mine.

Connellsville Coke—Coke conditions have not improved and prices are weak. Furnace coke for prompt shipment remains at $1.60 and on contract at around $1.80. Prices of foundry coke are very irregular. For the best grade $2.25 is readily obtained on contract and for spot shipment, but sales of inferior grades have been made at considerably less. One large independent concern this week closed several contracts at the $2.25 rate. Less than one-half of the 37,000 ovens in both of the Connellsville fields are in operation. The *Courier* gives the production in both regions at 147,148 tons. Shipments, 6033 cars as follows: To Pittsburg, 2144 cars; to points west of Connellsville, 3433 cars; to points east, 446 cars.

Foreign Coal Trade

Imports and exports of coal in Germany, two months ended Feb. 29, in metric tons:

Imports:	1907.	1908.	Changes.
Coal	1,570,267	1,357,177	D. 213,090
Brown coal	1,237,226	1,364,119	I. 126,893
Total coal	2,807,493	2,721,296	D. 86,197
Coke	52,250	84,163	I. 31,913
Briquets	22,347	31,439	I. 9,092
Exports:			
Coal	3,144,419	3,138,626	D. 5,793
Brown coal	2,696	4,043	I. 1,347
Total coal	3,147,115	3,142,669	D. 4,446
Coke	583,940	664,031	I. 80,091
Briquets	192,765	271,279	I. 78,514

Included in the coke exports this year were 830 tons to the United States.

Fuel exports from Great Britain, with coal for use of steamers in foreign trade, were as follows for the three months ended March 31, long tons:

	1907.	1908.	Changes.
Coal	13,731,487	14,211,160	I. 479,673
Coke	238,033	280,955	I. 42,922
Briquets	344,744	378,612	I. 33,868
Total exports	14,314,264	14,870,727	I. 556,463
Steamer coal	4,424,009	4,704,209	I. 280,200
Total	18,738,273	19,574,936	I. 836,663

Larger exports in 1908 were 2,768,210 tons to France, 2,084,870 to Italy, 2,008,753 to Germany, and 676,428 to Argentine Republic.

Coal production of Germany, two months ended Feb. 29, metric tons:

	1907.	1908.	Changes.
Coal	23,468,045	25,221,866	I. 1,753,821
Brown coal	9,902,808	11,106,716	I. 1,203,908
Total mined	33,370,853	36,328,582	I. 2,957,729
Coke made	3,424,881	3,634,541	I. 209,660
Briquets made	2,468,225	2,936,120	I. 467,895

Of the briquets reported this year 2,269,603 tons were made of brown coal, or lignite.

Iron Trade Review

New York, April 22—The condition of the trade shows no appreciable improvement. The sales of pig iron have been small and irregular, nearly all of the business going to furnaces which are not maintaining prices. Southern makers have taken most of the business. A meeting was held in New York this week, at which it was resolved to maintain prices; but not over 30 per cent. of the furnaces represented were in blast. It is evident that the difficulty of holding to present quotations is increasing.

In finished material business remains light. Structural steel shows the most activity, a number of small contracts being under negotiation and a few placed. In several cases fabricating companies have taken contracts on a basis which implies a considerable reduction in cost of material. Presumably they are confident of securing steel at lower prices, notwithstanding the continued assertion that these are being maintained. Railroad orders are still lacking, with the exception of a few for rails.

Birmingham

April 20—A better inquiry for iron was felt by the Alabama producers during the past week and as a consequence there was much talk of an advancing market. In more than one office it was asserted that No. 2 foundry iron was being held for $13 per ton. The price current during the past four weeks and longer has ranged between $12 and $13.

Reports have been common recently that considerable export business has been accepted by Southern manufacturers, and for some time to come there will be shipments from the Birmingham district. Since the filling of the 3500-ton order, shipped to Genoa, Italy, another 1000 tons was sent in the same direction. Reports heard are that more than 100,000 tons will be shipped abroad this year.

Chicago

April 20—The pig-iron market continues to be dull. Sales are confined to current needs, and inquiries do not develop into contracts to any large extent. A good sized order probably could be placed for Southern iron at a very low figure, considerably under the $12 Birmingham adhered to as the standard quotation for No. 2 foundry. The consumer would seem to have the better of the waiting game, except for Northern iron, which has been so well regulated as to production that those having iron to sell can afford to stand and do stand firm.

The $12 Birmingham price makes a Chicago price of $16.35, against which No. 2 Northern sells for $17@17.25. Lake Superior charcoal sells in like manner for $21@21.50.

Coke is quiet, shipments being restricted to supplying the small demand, with the best Connellsville at $5.

Structural steel is finding a market again and railroad supplies show an improving tendency. For billets, plates, bars and other forms there is a very small demand.

Philadelphia

April 22—The eastern Pennsylvania sales of pig iron are still of moderate proportions and at the low level of prices heretofore prevailing. Our buyers, almost to a man, say their policy is to buy only as they need iron. A little improvement is felt in foundry business and more foundry will soon be needed. No change in quotations.

Billets—The consumption in this territory is light and manufacturers are buying only as they must. Prices are weaker on large orders.

Bars—Large orders for bars could be placed at a further shading. The opening of spring has not brought the anticipated rush of business in bars.

Merchant Steel—There is an improving tendency in the demand at stores.

Plates—The undertone of the market is stronger, not particularly because of new business actually secured, but because of some evidence of an enlarging demand.

Structural Material—The feature this week is the inquiry coming from contractors for early and mid-summer deliveries. Prices are low and this is drawing the business.

Steel Rails—Small orders for light rails amounting to a few hundred tons have been placed.

Old Material—Quite an amount of railroad scrap will change hands soon. Other kinds do not show any activity.

Pittsburg

April 21—A decided improvement in the operation of iron and steel mills in the Pittsburg and surrounding territory is noted this week. It is not due to the receipt of large contracts, but to the accumulation of small orders, and there is no positive indication that the improvement will continue. The structural mills at the Homestead works of the Carnegie Steel Company are more active and the Duquesne plant is running satisfactorily on sheet and tin-plate bars. The Edgar Thomson rail plant which had been idle for two weeks was started on Sunday night and the three mills are being operated to nearly 40 per cent. of capacity. The steel plant of the Republic Iron and Steel Company, which has been idle for over two weeks, went on in full this morning, and the Valley works also went on in full. The Brown-Bonnell plant is operating to about one-half capacity. The National Tube Company is operating its plants in this district to about 50 per cent.

of capacity. Spang, Chalfant & Co. started the pipe mill in full on Monday. Wire mills continue to operate to about 70 per cent. of capacity.

Small orders in various lines of finished steel products continue to come in, and while the large producers have taken a determined stand in the movement to maintain prices, some cutting is reported, principally in bars, structural material and light rails.

Pig Iron—The market continues dull and uninteresting. Prices in all grades are weak. Bessemer iron is still quoted by the large producers at $17, Valley furnaces, but sales have been made at $16.75. Basic and No. 2 foundry are quoted at $15.25, but it is believed that $15 can be done on foundry iron. There is no demand for gray forge and it is still quoted at $14.50. Of the 19 furnaces in the Valleys, seven are in operation.

Steel—There is no change in the market for billets. The price named of $28, Pittsburg, the mills absorbing half the freight from $1 to $3, is being maintained, but no sales of importance are noted. Sheet-bars continue at $29.50 delivered. Tank plate is firm at 1.70c., and merchant-steel bars at 1.60c.

Sheets—The market is unchanged. Black sheets are quoted at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-manganese—Prices have dropped 50c., being now $44.50@45 per ton.

Metal Market

NEW YORK, April 22.

Gold and Silver Exports and Imports

At all U. S. Ports in March and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Mar. 1908..	$ 1,447,206	$ 3,618,885	Imp. $2,171,679
" 1907..	2,126,173	5,046,243	" 2,920,070
Year 1908..	3,859,003	17,398,551	" 13,539,548
" 1907..	5,703,304	11,646,615	" 5,943,317
Silver:			
Mar. 1908..	4,329,369	3,723,307	Exp. $606,062
" 1907..	5,058,461	4,006,497	" 1,051,964
Year 1908..	12,586,257	10,796,986	" 1,791,271
" 1907..	14,669,396	11,385,526	" 3,283,870

Exports from the port of New York, week ended April 18: Gold, $1,005,529; silver, $845,030, both chiefly to London. Imports: Gold, $226,041, chiefly from Central and South America; silver, $8339, from Mexico.

Specie holdings of the leading banks of the world April 18 are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$296,676,100
England.....	$184,005,700	.....	184,005,700
France.....	559,198,100	$180,252,820	739,450,920
Germany.....	158,145,000	65,450,000	223,595,000
Spain.....	77,655,000	130,915,000	208,570,000
Netherlands....	38,482,000	21,722,000	60,204,000
Belgium.....	20,283,335	10,141,665	30,425,000
Italy.....	182,550,000	22,500,000	205,050,000
Russia.....	565,185,000	34,710,000	599,895,000
Aust.-Hungary.	232,345,000	65,515,000	297,860,000
Sweden.....	19,490,000	.....	19,490,000
Norway.....	7,290,000	.....	7,290,000
Switzerland....	16,815,000	.....	16,815,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Silver Market

SILVER AND STERLING EXCHANGE.

Apr.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Apr.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
16	4.8725	54⅞	25 1/16	20	4.8715	54⅝	....
17	4.8715	54⅞	....	21	4.8725	54⅝	25 1/16
18	4.8715	54⅝	25 1/16	22	4.8725	54⅝	25 1/16

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to April 9:

	1907.	1908.	Changes.
India.....	£4,149,408	£2,136,538	D. £2,012,870
China.....	.....	501,400	I. 501,400
Straits.....	204,050	78,270	D. 125,780
Total.....	£4,353,458	£2,716,208	D. £1,637,250

Imports for the week were £5000 from the West Indies and £191,000 from New York; £196,000 in all. Exports were £195,100 to India.

Other Metals

Apr.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
16	12¾ @13	12⅝ @12¾	58⅛	32	3.97½ @4.00	4.62½ @4.65	4.47½ @4.50
17	12¾ @13	12⅝ @12¾	.....	32	3.97½ @4.00	4.62½ @4.65	4.47½ @4.50
18	12¾ @13	12⅝ @12¾	.....	32	3.97½ @4.00	4.62½ @4.65	4.47½ @4.50
20	12¾ @13	12⅝ @12¾	.....	32	4.00 @4.02½	4.62½ @4.65	4.47½ @4.50
21	12¾ @13	12⅝ @12¾	58	31⅞	4.00 @4.02½	4.62½ @4.65	4.47½ @4.50
22	12¾ @13	12⅝ @12¾	58	31¾	4.00 @4.02½	4.62½ @4.65	4.47½ @4.50

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electroytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The market is dull and substantially unchanged. Sales of electrolytic have been made to domestic consumers at 12¾c., cash, New York, and to exporters at 12⅝. Business in Lake copper has been done at 12¾@13c., some fairly large lots near the lower figure. But in general the market has reflected the holiday spirit both as to domestic and foreign business, and has been featureless throughout the week. At the close the quotations are unchanged at 12¾@13c. for Lake copper; 12⅝@12¾c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 12⅜@12½ cents.

The movement in the standard market in London, which was reported last week, flattened out as quickly as it started, and at the close the market is lower at £58 for spot, £58 10s. for three months.

Statistics for the first half of the current month show an increase in the visible supplies of 400 tons.

Refined and manufactured sorts we quote: English tough, £61 10s.@62 10; best selected, £62@62 10; strong sheets, £73@74.

Manufactured Copper—Sheets, cold-rolled, 18c.; hot-rolled, 17c. Wire, 14¾c. base.

Tin—On account of the prolonged holiday abroad, there was not much life to the market either in London or here. Orders which were expected from this side failed to materialize, but as the supplies of tin are held by strong parties, prices did not recede to any large extent. The London market closes at £143 15s. for spot, £142 15s. for three months, while near-by tin in this market is quoted at about 31¾c. per pound.

Exports of tin from the Straits for the three months ended March 31 were 13,569 long tons in 1907, and 15,357 in 1908; increase 1788 tons.

Lead—While business has been less active, quotations have advanced a little, and the market closes steady at 4@4.02½c. New York. Sales have been made at St. Louis at 3.90c.

The London market has receded further, and the close is cabled as £13 7s. 6d. for Spanish lead, £13 10s. for English lead.

Spelter—Owing to the large acumulation in the hands of smelters, buyers are disinclined to place orders beyond their immediate requirements, and the volume of business is relatively small. The close is steady at 4.62½@4.65c. New York, 4.47½@4.50c. St. Louis.

The London market is unchanged at £21 5s. for good ordinaries, £21 10s. for specials.

Judge Burns, of the U. S. Circuit Court for Southern Texas, on April 22 gave a decision in the zinc-ore case, upholding the claims of the importers of zinc ore and sustaining in all particulars the decision previously rendered by the U. S. Board of General Appraisers.

Antimony—Large sales for forward delivery were made last week and the demand for spot metal is strong. The market abroad is firm. Quotations are 8⅞@9⅛c. for Cookson's; 8½@8¾c. for Hallett's; 8⅛@8¼c. for ordinary brands.

Aluminum—While the American producer still quotes 33c. for No. 1 ingot, it is stated that European producers are offering to accept large orders for American delivery at 30c. Rods and wire, 38c.; sheet, 40c. base.

Cadmium—In 100-lb. lots, $1.25 per lb., Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 45@50c., New York.

Quicksilver—New York, $45 per flask; San Francisco, $44.50@45.50, domestic; $43@44, export; London, £8 5s.; 1s. 3d. less from second hands.

Zinc Sheets—Base price is 7c. f.o.b., Lasalle-Peru, less 8 per cent.

Platinum—The market is dull and little business is being done. Prices unchanged at $26 for hard platinum, $23.50 for ordinary, and $16 for scrap.

Minor Metals—For minor metals and their alloys, wholesale prices are, f.o.b. works:

	Per Lb.
Cadmium, 99.5% f. o. b. Hamburg	$1.27@1.35
Chromium, pure (N. Y.)	80c.
Copper, red oxide	50c.
Ferro-Chrome (60% Cr., 6% C.)	12c.
Ferro-Chrome (60% Cr., 2% C.)	30c.
Ferro-Chrome (60% Cr., 1% C. or less)	50c.
Ferro-Molybdenum (50%)	85c.
Ferro-Titanium (20%)	85c.
Ferro-Tungsten (37%)	28c.
Ferro-Vanadium (25-50%, per lb. vanadium contents)	$5.25
Magnesium, pure (N. Y.)	1.50
Manganese, pure 98@99% N. Y.	75c.
Manganese—Copper (30@70%) N. Y.	45c.
Molybdenum (98@99%, N. Y.)	$1.50
Phosphorus, foreign red (f. o. b. N. Y.)	90c.
Phosphorus, American yellow (f. o. b. Niagara Falls)	42c.
Tungsten (best) pound lots	80c.
Ferrosilicon (50%) spot. Ex. ship Atlantic ports	$89 ton.

Petroleum Exports

Exports of mineral oils from the United States for the three months ended March 31 were as follows, in gallons:

	1907.	1908.
Crude petroleum	23,455,067	27,466,146
Napthas	5,728,238	5,767,424
Illuminating oils	202,170,386	248,879,259
Lubricating oils	33,336,044	40,994,905
Residuum	13,086,757	13,043,963
Total	277,776,492	336,151,697

Paraffin is included in lubricating oils. The total increase this year was 58,375,205 gal., or 21 per cent.

Missouri Ore Market

Joplin, Mo., April 18—The output was reduced approximately 700 tons last week by the heavy spring rains, and it is estimated that it will be reduced 1000 to 1200 tons this week by continued rains. Many mines at Granby, Aurora, Spring City and Spurgeon are temporarily abandoned.

The highest price paid for zinc ore was $39 per ton, on a base price of $36 per ton of 60-per cent. zinc, ranging down to $34 for a very few bins. A large portion of the shipment was sold on a base price of $35.50@36, and, with light silicate sales, the average price was advanced $1 per ton, with no change in the top price. The average of all grades was $34.84. The highest price paid for lead was $55 per ton, medium grades selling at $52@54 per ton, and all grades averaging $51.98 per ton.

Following are the shipments of zinc and lead from the district for the week ended April 18:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,279,550	809,810	$95,944
Joplin	2,533,680	277,270	52,813
Oronogo	1,583,820	.....	28,016
Galena	1,035,760	73,420	20,028
Badger	488,610	29,010	9,548
Alba-Neck City	463,430	9,590	8,821
Prosperity	336,260	111,310	8,777
Duenweg	336,470	33,170	6,749
Granby	400,000	13,000	5,050
Aurora	241,860	5,050	3,942
Carthage	192,340	.....	3,558
Quapaw-Baxter	174,430	.....	3,052
Sarcoxie	144,870	.....	2,462
Zincite-Sherwood	85,820	6,930	1,638
Spurgeon	91,270	3,990	1,021
Totals	12,388,180	1,372,550	$251,419
16 weeks	142,788,980	20,145,360	$2,977,220
Zinc value, the week, $215,734; 16 weeks, $2,477,518			
Lead value, the week, 35,685; 16 weeks, 499,702			

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	34.92	February	84.58	49.72
March	48.66	34.19	March	82.75	49.90
April	48.24	.....	April	79.76	.....
May	45.98	.....	May	79.56	.....
June	44.82	.....	June	73.66	.....
July	45.79	.....	July	58.18	.....
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	53.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43.40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

Wisconsin Ore Market

Platteville, Wis., April 18—The premium price of $38.50 per ton was paid this week for zinc ore, the base price ranging from $35 to $36 per ton of 60 per cent. zinc. The price paid for lead ore remained unchanged, $50 per ton of 80 per cent. lead. Ore shipment for the week was almost double the weekly average for the past five months. Considerable mining activity has asserted itself all over the district, in spite of adverse market conditions, and more producers are preparing to resume.

Ore shipments, week ended April 18, were:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton	540,000	153,410	.....
Platteville	489,100	45,870	.....
Galena	320,000	.....	.....
Cuba City	253,780	113,000	.....
Elmo	172,460	.....	.....
Highland	171,300	.....	.....
Hazel Green	82,000	.....	.....
Mineral Point	70,000	.....	.....
Harker	63,440	.....	.....
Linden	44,810	.....	.....
Livingston	30,000	.....	.....
Total	2,236,890	312,280	.....
Year to Apr. 18	21,026,920	1,461,955	79,800

The following camps made shipments in the preceding week, not heretofore reported: Linden, 123,150; Highland, 62,800; Harker, 62,730; total, 248,680 lb. zinc ore.

The statistics are based on the finished concentrates as delivered to the smelters. For this reason, 77,100 lb. zinc concentrates shipped from Linden and 53,800 lb. shipped from Benton to the electrostatic separator at Platteville during the week just closed are not included in the above tonnage classification, but will be included and reported in the finished product shipped to the smelters by the above plant.

Chemicals

New York, April 22—The general situation remains unchanged. Only a small volume of business is being done; price changes have been slight and have favored the buyer as a rule.

Copper Sulphate—The market is inclined to be stiff under a strong agricultural demand. Prices are unchanged at $5 per 100 lb. for carloads and $5.25 for smaller lots.

Nitrate of Soda—The market remains without any special features. Prices are 2.35c. for spot delivery and 2.30c. for other positions of 1908; 2.35c. for 1909, and 2.32½c. for 1910. The 96 per cent. grade sells 5c. per 100 lb. higher.

Mining Stocks

New York, April 22—The stock market this week was broken by a double holiday, the Exchange adjourning from Thursday over to Monday. The market on the remaining days was quiet, even dull, but without any special weakness. Some unfavorable points came up, including the taking of $2,500,000 gold for export. This movement is expected to continue for a time, as repayment of foreign loans may be required. The immediate effect upon the stock market, however, was small.

One sale of Homestake, of South Dakota, was reported, at $74 per share.

The curb market followed the exchange and was dull on all the business days of the week. Dealing in the copper shares was light, with only small changes in price. Other mining stocks showed little activity.

Boston

April 21—The week has been a short one so far as the stock market is concerned. In addition to closing Good Friday and the following Saturday, Patriots' Day was observed Monday, and this is a legal holiday in Massachusetts, thus giving three running days without a market. There has been little animation and prices have fluctuated within narrow limits, although at no time has there been any real weakness.

U. S. Coal and Oil has been the only stock that might be considered a feature. This stock spurted $3 to $23, and has held most of the advance. This company is

now in a fair way to give stockholders returns, it would seem. It has closed contracts for over 700,000 tons of coal this year, including, it is understood, a contract to deliver 75,000 tons of coal to the Calumet & Hecla, and 100,000 tons to a Western railroad. The Amalgamated dividend had no effect market-wise.

Calumet & Hecla is up $10 to $635 on light trading. Boston Consolidated hangs around $12 and under. North Butte's range has been from $51.50 to $53.

The Montana Coal and Coke Company is to raise $100,000, bearing 6 per cent. and running 10 years, by issuing 100,000 shares of stock at $1, after reducing the par from $10 to $1.

The curb has been quiet and featureless.

STOCK QUOTATIONS

NEW YORK	Apr. 21
Name of Comp.	Clg.
Alaska Mine	¾
Amalgamated	57⅞
Anaconda	37⅜
Balaklala	‡2⅛
British Col. Cop.	4⅞
Butte & London	⅛
Butte Coalition	21
Colonial Silver	½
Cum. Ely Mining	7⅞
Davis Daly	3
Dominion Cop	1½
Douglas Copper	4¾
El Rayo	1⅞
Florence	3⅞
Foster Cobalt	.60
Furnace Creek	.18
Giroux	3⅝
Gold Hill	⅜
Granby	‡90¼
Greene Gold	⅛
Greene G. & S	⅛
Greenw'r & D.Val.	.75
Guanajuato	2¼
Guggen. Exp.	158
Hanapah	.20
McKinley Dar	.68
Micmac	4
Mines Co. of Am.	1⅛
Mitchell Mining	1/16
Mont. Sho. C.	3⅝
Nev. Utah M. & S	3⅜
Newhouse M. & S.	6½
Nipissing Mines	6¾
Old Hundred	½
Silver Queen	1.05
Stewart	⅛
Tennessee Cop'r	39⅜
Tri-Bullion	1¾
Union Copper New	1
Utah Apex	4⅛
Utah Copper	30
Yukon Gold	4⅝

N. Y. INDUSTRIAL	
Am. Agri. Chem.	‡17¾
Am. Smelt. & Ref.	69⅛
Am. Sm. & Ref., pf.	95⅛
Bethlehem Steel	‡15⅝
Colo. Fuel & Iron	24¾
Federal M. & S., pf.	70
Inter. Salt	14½
National Lead	54½
National Lead, pf.	95½
Pittsburg Coal	‡10
Republic I. & S.	17
Republic I. & S., pf.	66
Sloss-Sheffield	43½
Standard Oil	574
U. S. Red. & Ref.	....
U. S. Steel	35¼
U. S. Steel, pf	99⅜
Va. Car. Chem	‡20¼
Va. I. Coal & Coke	48

ST. LOUIS	Apr. 18	
N. of Com.	High.	Low.
Adams	.40	.25
Am. Nettie	.03	.02
Center Cr'k	2.00	1.50
Cent. C. & C.	66.00	64.50
C.C. & C. pd.	76.00	75.00
Cent. Oil	100.00	90.00
Columbia	4.00	3.00
Con. Coal	19.00	16.00
Doe Run	125.00	110.00
Gra. Bimet.	.25	.20
St. Joe	15.00	12.00

BOSTON	Apr. 21
Name of Comp.	Clg.
Adventure	1⅛
Allouez	24¾
Am. Zinc	24¼
Arcadian	‡3½
Atlantic	9
Bingham	.50
Boston Con	11½
Calumet & Ariz*	99
Calumet & Hecla	635
Centennial	21
Con. Mercur	.35
Copper Range	64¼
Daly-West	9
Franklin	6¾
Greene-Can	7⅞
Isle Royal	18
La Salle	13⅛
Mass	‡2⅝
Michigan	‡10¾
Mohawk	48
Nevada	11¼
North Butte	52¼
Old Colony	.85
Old Dominion	33
Osceola	‡83
Parrot	18¼
Quincy	83
Rhode Island	2½
Santa Fe	‡1⅞
Shannon	11¼
Superior	‡15
Tamarack	‡59
Trinity	13½
United Cop., com.	‡6¾
U. S. Oil	21½
U. S. Smg. & Ref.	38
U.S.Sm. & Re., pd.	40
Utah Con	38¾
Victoria	2
Winona	5
Wolverine	125
Wyandotte	‡.70

*Ex. Div. †Ex. Rights. ‡Last quotation.

BOSTON CURB	
Ahmeek	65
Ariz. Com	‡18½
Black Mt.	5¼
East Butte	4
Hancock Con.	5
Keweenaw	‡4¾
Majestic	1
Raven	1 7/16
Shawmut	.33
Superior & Pitts	12
Troy Man	‡.55

LONDON	Apr. 22		
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton'sInd.	0	3	0
Camp Bird	0	14	0
Esperanza	1	7	6
Tomboy	1	11	3
El Oro	1	4	3
Oroville	0	12	3
Somera	...		.
Utah Apex	...		.
Ariz. Cop., pfd.	...		.
Ariz. Cop., def.	...		.

Cabled through Wm. P. Bonbright & Co., N.Y.

NEVADA STOCKS. Apr. 22.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.20
Belcher	.10	St. Ives	.32
Best & Belcher	.55	Triangle	.08
Caledonia	.13	BULLFROG STOCKS	
Challar	.10	Bullfrog Mining	.07
Comstock	‡.24	Bullfrog Nat. B.	.10
Con. Cal. & Va	.45	Gibraltar	.08
Crown Point	.43	Gold Bar	.16
Exchequer	.20	Homestake King	.29
Gould & Curry	.10	Montgomery Mt.	.13
Hale & Norcross	.30	Mont. Shoshone C.	3.25
Mexican	1.20	Original Bullfrog	.02
Ophir	2.40	Tramp Cons	.22
Overman	.09	MANHAT'N STOCKS	
Potosi	.15	Manhattan Cons.	.13
Savage	.26	Manhat'n Dexter	.05
Sierra Nevada	.38	Jumping Jack	.03
Union	.35	Stray Dog	.04
Utah	.03	MISCELLANEOUS	
Yellow Jacket	.73	Golden Boulder	.07
TONOPAH STOCKS		Bonnie Clare	.15
Belmont	1.12½	Lee Gold Grotto	...
Extension	1.18¾	Nevada Hills	2.50
Golden Anchor	.04	Nevada Smelting	1.25
Jim Butler	.32	Pittsburgh S. Pk.	1.12½
MacNamara	.31	Round Mt. Sphinx	.28
Midway	.64		
Montana	1.72		
North Star	.13		
Tono'h Mine of N.	8.68¾		
West End Con	.40		
GOLDFI'D STOCKS			
Adams	.05		
Atlanta	.24		
Booth	.20		
Columbia Mt	.20		
Comb. Frac	.66		
Cracker Jack	.08		
Dia'dfield B. B. C.	.16		
Goldfield Belmont	.15		
Goldfield Con	5.43¾		
Goldfield Daisy	1.11		
Great Bend	.51		
Jumbo Extension	.31		
Katherine	.05		
Kendall	.24		
Lone Star	.09		
May Queen	.08		
Oro	.09		
Red Hill	.25		
Roanoke	.02		
Sandstorm	.35		

COLO. SPRINGS Apr. 18

Name of Comp.	Clg.
Acacia	....
Black Bell	3
C. C. Con	....
Dante	9
Doctor Jack Pot	7
Elkton	51
El Paso	32
Findlay	25¼
Gold Dollar	6⅝
Gold Sovereign	3
Isabella	34
Index	....
Jennie Sample	2⅝
Jerry Johnson	....
Mary McKinney	28½
Pharmacist	3⅝
Portland	1.05
Un. Gold Mines	4¾
Vindicator	80
Work	11½

New Dividends

Company.	Payable.	Rate.	Amt.
Am. Ag. Chem., pfd	Apr. 15	$3.00	$544,590
Amalgamated	May 25	0.50	765,439
Anaconda	Apr. 15	0.50	600,000
Boston & Montana	Apr.	3.00	450,000
Calumet & Arizona	Apr. 25	1.00	200,000
Central C. & C., com	Apr. 15	1.50	76,875
Central C. & C., pfd	Apr. 15	1.25	23,438
Consolidation Coal	Apr. 30	1.50	153,750
Elkton	Apr. 24	0.01½	37,500
Esperanza	Apr. 18	1.00	495,950
Homestake	Apr. 25	0.50	109,200
Inter. Nickel, pfd	May 1	1.50	131,123
Jamison	Apr. 18	0.02	7,800
Kerr Lake	Apr. 15	0.15	90,000
Minas Pedrazzini	Apr. 1	0.05	50,000
Nipissing	Apr. 20	0.15	180,000
N. S. St. & Coal, com	Apr. 15	1.50	74,814
N. S. St. & Coal, pfd	Apr. 15	2.00	20,600
N. Y. & Hond. Rosario	Apr. 25	0.10	15,000
Penn. Salt Mfg	Apr. 15	3.00	180,000
Portland	Apr. 15	0.04	120,000
United States, com	Apr. 15	0.50	175,466
United States, pfd	Apr. 15	0.87½	425,114
Utah Con	Apr. 15	0.50	150,000
Va. Car. Chem., pfd	Apr. 15	2.00	360,000
Vindicator	Apr. 25	0.04	60,000

Assessments

Company.	Delinq.	Sale.	Amt.
Big Creek, Ida	Apr. 17	May 16	$0.01
Blue Bell, Utah	Feb. 15	Apr. 15	0.01
Butler-Liberal, Utah	Apr. 25	May 13	0.02
Butte & Yerrington, Nev	Mar. 25	Apr. 16	0.02
Century, Utah	Apr. 14	May 14	0.02
Champion, Cal	Apr. 2	Apr. 22	0.50
Charm, Utah	Apr. 31	May 13	0.01
Con. Imperial, Nev	Mar. 11	Apr. 2	0.01
Eastern & Western, Utah	Mar. 16	Apr. 6	0.01
Federal	Apr. 25	May 18	0.05
Imlay	Apr. 8	Apr. 25	0.01
Old Evergreen	Apr. 14	May 14	0.01
Oro Cobre, Cal	Apr. 17	May 16	0.02
Posey Canyon, Cal	Apr. 28	May 16	0.02
Quincy, Jr., Utah	Mar. 21	Apr. 20	0.02
Scottish Chief, Utah	Mar. 18	Apr. 10	0.01
Silver Bell, Utah	Apr. 10	Apr. 27	0.01
Skylark, Utah	Mar. 27	Apr. 14	0.01
Sierra Queen, Cal	Mar. 15	Apr. 3	0.02
Western Mines, Nev	Mar. 16	Apr. 23	0.01½

Monthly Average Prices of Metals

AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	55.365	31.325	25.570
April	65.462	.....	30.253	.....
May	65.981	.....	30.471	.....
June	67.090	.....	30.893	.....
July	68.144	.....	31.366	.....
August	68.745	.....	31.637	.....
September	67.792	.....	31.313	.....
October	62.435	.....	28.863	.....
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12.875	106.594	58.761
April	24.224	.....	25.260	.....	98.625	.....
May	24.048	.....	25.072	.....	102.375	.....
June	22.665	.....	24.140	.....	97.272	.....
July	21.130	.....	21.923	.....	95.016	.....
August	18.356	.....	19.255	.....	79.679	.....
September	15.565	.....	16.047	.....	68.375	.....
October	13.169	.....	13.551	.....	60.717	.....
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	.....
February	42.102	28.978	August	37.667	.....
March	41.313	30.577	September	36.689	.....
April	40.938	.....	October	32.620	.....
May	43.149	.....	November	30.833	.....
June	42.120	.....	December	27.925	.....
			Av. year	38.166	.....

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	.....	19.975	.....
May	6.000	.....	19.688	.....
June	5.760	.....	20.188	.....
July	5.288	.....	20.350	.....
August	5.250	.....	19.063	.....
September	4.813	.....	19.775	.....
October	4.750	.....	18.531	.....
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26.094	21.075
April	6.685	.....	6.535	.....	25.900	.....
May	6.441	.....	6.291	.....	25.563	.....
June	6.419	.....	6.269	.....	25.469	.....
July	6.072	.....	5.922	.....	23.850	.....
August	5.701	.....	5.551	.....	21.969	.....
September	5.236	.....	5.086	.....	21.050	.....
October	5.430	.....	5.280	.....	21.781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.